American Machinist

Volume 55 NEW YORK, JULY 21, 1921 Number 3

Organization and Management of the Small Shop

The Necessity of Organization in the Management of the Small Shop—How One Small Shop Started and Won a Battle Against Odds

By ELMER W. LEACH

THE necessity of organization in the management of the small shop has prompted me to select that phrasing only after considerable thought, because it has a very definite suggestion in its wording which I wish to have clearly understood at the outset. And this is it, that a small shop, no matter how very, very small it may be, can have and must have an organization and a management just the same as any million dollar corporation, if it is to be operated profitably and successfully.

There are some short-sighted persons who go into the manufacturing business on a limited scale with the original conviction that because their plant falls into that class known as "small shops," it is not necessary to keep a set of books, to make any special or methodical attempt to sell their goods, or to watch purchases, production, profits and the hundred and one other things that really must be watched; in fact, they seem to believe that their business will continue from one month to the next and from one profit to a larger one without any conscientious and concerted planning and striving toward bigger things.

How quickly such people are disillusioned. We read of some great captain of industry who has amassed a tremendous fortune. We read about the wonderful organization of which he is the head, and of the extensive system of production units and sales departments which he has established in every corner of the world. There is an irresistible tendency to say to ourselves, "Fortunate fellow, he was born under a lucky star."

But there is no luck about it, and I have never known any instance where the stars entered into the factors determining such a man's success. Back of every story of individual accomplishment which may have been brought to your attention is another story that the outside world does not so often learn, a story of a gigantic effort that ninety-nine other men may have declared to be physically impossible, but which the one man was big enough and bold enough to attempt.

Hard Work Necessary

There are certain elements entirely beyond your control which will affect your business so as to bring unhoped for successes or unexpected set-backs and misfortunes, but no business man has ever trusted to the element of luck in forming his plans and policies. No business man has ever attributed any material portion of his success to luck. And so we should not do our industrial leaders the injustice of presuming that their accomplishments have been possible through anything but real, honest hard work; and work with a very definite purpose and object in view.

Those who are contemplating organizing a small manufacturing business or those who may already have begun such an undertaking will do well to recall that "The path of life is not flowing with milk and honey, nor is it strewn with roses and violets." It is a hard, true rule that you get out of life in proportion to what you put into it, which is also true of business. Your success in business will be directly proportionate to your effort toward success, and it will come only when you work for it, and only as you earn it.

Lord, Save Us From Our Friends!

Do I discourage you? That is quite opposite to my desire. There will be any number of other persons to do that when you announce your intention to enter business. They will examine your product and tell you the idea is not new. They will say there is something similar on the market in much simpler form at a much smaller price. They will declare that it will take thousands of dollars in advertising to create a demand for your goods and that when you have done so some large corporation will cut in on your market with methods of competition against which your little enterprise can never hope to survive.

By the dozens, supposedly sincere friends have come to every man of courage and vision and predicted embarassing failure within a few months; they have proved the utter impossibility of his plan.

But we heard the same type of prophets explain why the French could not prevent the Germans from entering Paris on September first in 1914. I read of one gentleman who, through a very unusual and yet possible mix-up by a marriage to a lady whose daughter had at the same time married his own father, was able to prove seriously that he was his own grandfather!

The Value of Real Friends

One is fortunate indeed if he has friends who can give really intelligent information which will help him in analyzing his problems and arriving at decisions; and it is entirely possible that your first intentions and plans may be too pretentious or too inconsistent with reasonable probabilities. In that event, you should be glad if some one brings to your attention facts which you had overlooked by not appreciating their bearing on your problem. Never refuse to listen to advice, but do not accept it blindly as sound even though it may be offered in all sincerity.

Some people say that the business world is overcrowded and that there are no opportunities today such as were open to Henry Ford or to Thomas Edison when they were young men.

It is true that Henry Ford developed the idea of an inexpensive automobile and Thomas Edison the incandescent light, the talking machine and other ideas; they took basic ideas which had not been presented to the world before even in a crude way and developed them into what are now two of our largest industries. And there are other men who have taken ideas from their conception and carried them through to practical form and successful application and development; but that does not necessarily mean that the field is overcrowded or that the possibilities are exhausted.

No, the field of business is still bigger than the biggest man who has ever entered it. New machines, new products, new processes are being offered to the world every day of every year; and some place in that ever-increasing complexity of our industrial development there is a definite corner for the that idea which you may have hesitated to submit to the competition of the commercial market.

Whether it be an improvement on some product already in use or an entirely new article; whether it be a hammer of new shape or a new style of monotype; in other words, whether it be large or small, simple or complex, modest or pretentious; if it is practical, if it can be manufactured economically, and if it has a permanent and substantial market, then do not let ten thousand pessimistic advisors deter you from developing your idea.

Success and Hard Work

Your success is certain. It is merely dependent upon how hard you are willing to work for it and how earnestly you enter into the accomplishment of your ambition.

The World War did some strange things with the minds of men. Some men, from the bigness and vastness of it all, lost all belief in the possibility of individual effort accomplishing anything worth while or receiving any deserved reward. Having been one small part of a gigantic machine (in which individuality really was entirely destroyed) they returned to civilian pursuits and found it impossible to remold themselves so as to fit into the civilian world where different conditions obtained.

Then there were others who entered the service with patriotic ambitions and a desire to have an active combatant part in the actual crushing of the enemy. For some reason, however (usually because of qualifications which made them more valuable on this side of the water or at least away from the battle zones) they were withheld from participation in the real fighting, and were kept throughout the period of the war at some dull and uninteresting task which seemed to them quite unimportant and unnecessary.

Such men, in most cases, returned to civilian life thoroughly disgusted with thier experience and with the emotions which had prompted them to enlist in the service of the flag. It will take some of them a long while to realize that they had just as real and just as praiseworthy a part in bringing about the final victory as though they had gone into battle and done their bit with rifle and bayonet.

But there were also countless men who enlisted in the service of their country with the same determination to advance that had characterized them before. The bigness of that thing of which they were a part only served to awaken in them a restlessness which, on return to civilian life, developed into a real dissatisfaction over conditions with which they had formerly been content. Those young men were not willing to back into the same old channels.

They were not to be satisfied with the same old job under the same old conditions and terms. They had a new conception of the relative importance of the world's goods; and they resolved to extend that red-blooded spirit which had carried them along to victory and let it permeate into their business activities and help them win new battles and gain new objectives in a different sort of struggle.

It was such emotions that brought me back from the biggest army in the world and put me into the smallest shop in the world.

My definite intention to organize a small shop was formed while I was still in the service. Previous to entering the army I had spent my entire working life of five years at a single plant. I had started in with this company as a draftsman at fifteen cents an hour. That work gave me a good detailed knowledge of its products from the mechanical standpoint.

Later on, in order that I might have actual practical experience to tie up with my drafting work, I donned overalls, bought a tin dinner-pail and went into the factory, working at various times in the machine shop, the pattern department, the assembly floor, the electroplating shop, the foundry—in fact there was not a single department of that plant in which I was not given an opportunity to "learn the ropes."

All this time I was being given a thorough training in various departments of a modern manufacturing plant, in the various phases of business practise. I was learning the problems of business from every angle.

Later on it was my enjoyable privilege to represent this company on the road from Seattle to New York and from Duluth to San Antonio, getting the outside viewpoint which one can never receive inside the plant. This work gave me a combination of opinions which enabled me to look more broad-mindedly at the problems of our sales and production departments. It is the actual, personal contact with a firm's distributors which permits one to grasp the true marketing policies that can be most effective.

At still later times the positions of assistant sales manager and lastly advertising manager were given me to fill, rounding out in that last capacity a business education covering a period of five years which one could not obtain in five times five years in our most highly specialized business universities.

I do not mean to discount the value of a business education. I received a university training, and use portions of that training in my daily experiences. But one can never get in his schooling that practical element, that responsibility of dollars and cents, which he must recognize when he enters business, whether for himself or in the employ of others. The best training for a business career is in the business world itself.

Positions such as I held and education such as I received really permit a man to say to himself with confidence, "I know my business thoroughly." And unless you can say that to yourself about the field in which you are about to enter it is not yet time for you to trust your future and your capital to the dangers of mismanagement through lack of knowledge.

While I was in the service I was approached by a gentleman who had taken out several patents pertaining to the kind of machinery with which I was familiar.

He was a practical inventor; not the "bug-house" variety, but a technical man capable of originating ideas and with the knowledge of factory methods to manage the developing of those ideas in their practical form.

The Three Elements of a Manufacturing Business

His machines possessed unquestionable merit, so that I had in them the first requisite for a manufacturing business—a product. I had had personal contact with jobbers in thirty states through whom such equipment could be sold, and there was the second necessary element—the market.

But neither of us had the third very essential requirement—the capital; so that our main problem was a financial one. It is one thing to create a marketable idea, but it is quite another thing to interest some outside influences to the extent of obtaining sufficient capital to organize a going manufacturing business that can produce your products at a profit.

Fortunately, however, we were able to raise five thousand dollars with which we rented a small building, purchased equipment, made patterns and jigs and announced to the trade the presence of a "world-beater."

In placing a new article on the market one has two main problems—one is production and the other is marketing.

The first can be solved to a large extent with pencil and paper by men with sufficient technical knowledge. A man who has successfully managed a large wartime ordnance plant can study a small, simple machine such as our first one was and predetermine what its approximate cost will be and what equipment will be needed to build it. So it is not always very difficult to answer the question, "Can we build it?"

The writer will always believe that the more important question of the two is, "Can we sell it?" The first question is answered by ourselves but the second is largely dependent on the public, or on that portion of the public which may constitute possible prospects for your goods.

And you can never say with certainty what someone else will do. You will pardon me, I am sure, for reviving a past feud so often but I do like to draw illustrations from our late friend, the former Kaiser. Poor Bill couldn't say with certainty what the Doughboys would do if they landed in France. And because he couldn't prevent them from landing in France in tremendous numbers and because he couldn't control their activities after they landed in the way he wanted to, a disastrous monkey wrench was thrown into the transmission of his war machine, making it a mighty unprofitable and unhealthy business venture to be connected with.

Responsibility for Failure

Many a small business has been founded on reasonable possibilities and been backed by all necessary enthusiasm, effort and capital, and yet it has gone down to failure because its owners did not consider "the other fellow," and analyze the probable actions which he might follow.

Many a plant has been built and equipped for the manufacture of a certain product only to remain idle because the goods could not be marketed. That is the most disheartening kind of failure. One is tempted to place the blame for such a failure on the buying market, and yet that is not the correct disposition of responsibility for lack of success at all.

The blame, the sole blame, rests on the man or men who did not investigate the market for their goods and acquaint themselves with its probabilities and its limitations before concerning themselves about the details of the design and construction of their product.

We started actual production of but a single machine, a simple product that retailed at only twelve dollars. We knew before we ever established that price that we could produce it in quantities to sell profitably at that figure.

But this was our sales problem. There were about a dozen of these machines in our own city that had been in use for one or two years. Outside of our own "home town," however, our product was not known and the name of our company never heard of. The company with whom I had been previously connected had three machines on the market accomplishing the same purpose. There were thousands of these machines giving satisfactory service in shops in every section of the country; in fact, in every country bordering on the seven seas. Two other companies in the country also made machines similar in purpose, and all these other machines were backed by successful performance over a period of years and by large corporate organizations.

In addition to those conditions the design of our machine made it necessary that we sacrifice part of our profit (that is, the profit we had figured there would be that first year) or place our list prices actually higher than those of any of these other companies with whose products the trade was well acquainted.

We chose the latter. We established our higher price, and offered our machine to the market on the basis that it was better in quality, design, construction and ease of operation.

Our locally situated competitor had about five hundred jobbing accounts throughout the country which he had obtained through twelve years of effort. In less than one year we had one hundred and twenty-five of those concerns handling our equipment which had by that time developed from a single machine into a comprehensive line of seven machines!

Those jobbers were scattered in the four corners of the country; in fact, at the end of that first year we had one account in Canada and two in England. And this with unheard-of, higher priced machines in a market already occupied by firms with an established reputation for producing quality products.

Our first piece of advertising matter did not go into the mails until three months after we had organized; our first machine was not shipped from our shop until three months after we had opened our doors and begun operation. And yet, in the remaining nine months of that year we established ourselves on a profitable production basis and showed one-fourth as many accounts as our other local company had built up in twelve years. There, I believe, was an accomplishment of which any small shop owner could well be proud. And remember that it was done on quality and not on price.

It does not take many words to tell of the accomplishment of that first year. But the success was earned by hard, hard work and only after discouragements which brought us more than once face to face with the question as to whether or not it was worth while to stay in the fight any longer.

There comes a time in every business when it is much easier to quit than to keep on. Such a time came

to us exactly on Christmas Day (of which more later on), on what God had intended to be a merry Christmas. But we chose to keep on though it was the harder course to take, and out of it all came a success that was well worth the struggle.

The work of that organization is by no means completed. The shop is now much larger, and today's successes bigger in many ways than those of the earlier history. The writer is not now actively engaged with his original "small shop" although he is still in very close personal touch with its problems and its policies. He has since seen fit to devote his time to other larger organizations, but he shall always believe that his biggest individual accomplishment was the organization and management of a small shop.

That was the experience which made me see the need of a help for other men who might be steering themselves into a similar channel. The store of technical literature is conspicuously lacking in practical assistance for "the little fellow." Books on factory management and sales management do not present those problems in such a way that the information can really be used by a man just establishing a small manufacturing business. More often than not they leave one so "snowed under" with a mass of systems so clearly too elaborate for his needs that the most likely result is a thorough misunderstanding of the true value of "sensible system."

The writer plans to present a reasonable mixture of theory and practice. However, everything that is offered you is the fruit of actual, personal experience. It is not guesswork. The methods explained and the suggestions offered have all stood the test of practical performance in a small shop. They are written from the viewpoint of the small shop owner with a hope that they may provide information which will help guide small manufacturing concerns safely through the first days and early struggles to the final successes which are always waiting as a reward for effort.

The Selection of Apprentices—Discussion

By F. P. Adelbert

Under the above title on page 455, Vol. 54, A. W. Forbes writes his views on an ideal apprentice system. It is not very surprising that "he has not had the nerve to try them in his own shop" though it appears extremely doubtful if his plan would attract a great many prospective mechanics, for he does not seem to make much allowance for the boys' point of view.

He would have the boy consider the apprenticeship as attractive as a college education and expects to divert the boys from college to the shops.

Now, a boy who goes to college, or at least the one who would be a prospective mechanic, does so with certain ideals in mind. He or his parents expect, for the sacrifice of time and money, to derive definite results such as a broad foundation for future great advances, and incidentally to gain a very definite distinction as a graduate of a certain school. Can Mr. Forbes honestly say that his shop or any other that he has in mind would give an equal foundation for advance or equal distinctions to a graduate of their apprentice course? Until it does so, not in theory but in actual practice, it is idle to expect the boy and his parents to make equal sacrifice, if both ways are open to him.

Neither can the shop offer the attractive atmosphere of the college. One has only to picture a comparison of the college boy as presented in "movies," literature and advertising to see that the average prospective college student or one of equal mentality is not going to be diverted to a suit of overalls and eight hours a day in a shop environment.

At the apprentice age the boy's parents must think for him, and their thinking is largely influenced by their judgment of the shops they work in and the men at their head. If good apprentices cannot be had it is because their fathers who work in our factories have formed the conclusion that the returns are not worth the demands. We can only change this by offering greater inducements to the immediate generation of apprentices. If the next generation of fathers are caught young enough and properly educated, Mr. Forbes' plan might work out.

Transmission Formulas for Balata and Fabric Belts

By W. F. Schaphorst

The writer has developed the following formula for Balata belts. It is based on a well-known table as published by a prominent belt manufacturer:

$$W = \frac{H}{0.000158\,ND\,(P-1)}$$

where W = width of belt in inches;
H = horsepower to be transmitted;
N = number of revolutions per minute;
D = diameter of pulley in inches;
P = number of plies.

This formula is usable for Balata belts of 3, 4, 5, 6, 7, 8, 9 or 10 ply.

The rules as ordinarily given for fabric belts made up in plies are something like this: "A 4-ply stitched canvas belt is equivalent to a single leather belt; 8-ply is equivalent to a double leather belt," and so forth. After knowing the equivalent we have to hunt up our rules of thumb for leather belts before being able to decide on a width necessary for a given drive.

The writer has hashed over these rules and equivalents and has hit upon a formula that gives a direct answer without mentioning leather at all. The formula herewith applies to most ordinary belts made up in plies such as rubber and stitched canvas.

$$\frac{WS}{\frac{2640}{P} + 136} = H$$

where W = width of belt in inches;
S = speed of belt in feet per minute;
P = number of plies;
H = horsepower.

For example, what horsepower may be transmitted by a 10-ply canvas belt, whose width is 6 in. and whose speed is 4,000 ft. per minute?

Substituting in the formula, we get $H = 60$.

Changed into its other forms for the determination of W, S or P, we have:

$$W = \frac{H}{S}\left(\frac{2640}{P} + 136\right);$$

$$S = \frac{H}{W}\left(\frac{2640}{P} + 136\right);$$

and

$$P = \frac{2640}{\frac{WS}{H} - 136}.$$

Some Unusual Features of the Rolls-Royce Car

Power Transmitted Through Large Ball Joint—Bracing Used at Rear End of Chassis—Axle and Torque Tubes Made of Steel Forgings

BY FRED H. COLVIN
Editor, *American Machinist*

SOME details of the design of the Rolls-Royce car are rather unusual in automobile practice and involve different construction which in turn requires special machining methods. Fig. 1 shows the rear end of a Rolls-Royce chassis in which the cross tube can be seen at *A*. The two brackets *B* and *C* support the trunnions of the internal control sphere which is shown in various stages of completion in Fig. 2. Surrounding this is the external control sphere *D*, Fig. 1. With the inner control sphere held firmly in place the outer control sphere, which is of bronze, forms the floating connection with the rear axle through the torque tubes *E* and *F*. The torque tubes, the differential housing *G* and the rear axle tubes *H* and *I* are all of forged steel and with the exception of the differential housings are machined all over, so as to insure uniform thickness and lightness of weight with adequate strength.

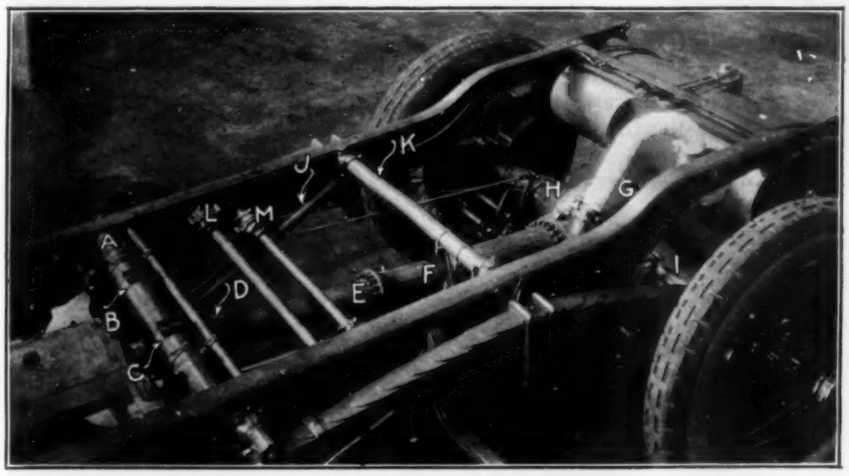


FIG. 1. CONSTRUCTION OF THE REAR END OF THE CHASSIS

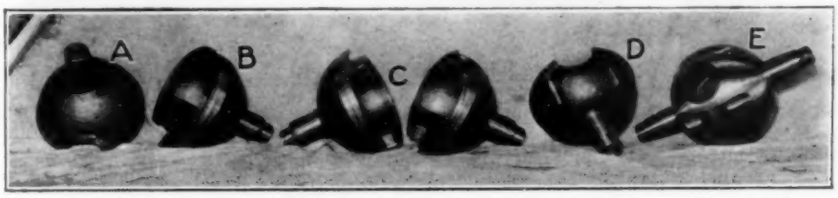


FIG. 2. THE INTERNAL CONTROL SPHERE IN DIFFERENT STAGES

This view also shows the bracing at the rear end of the chassis such as at *J* and the crossbrace *K*. Cases *L* and *M* contain small geared differentials on the brake shaft so as to equalize the pressure exerted on the brake drum. Wire cable is used instead of brake rods so as to avoid any tendency to rattle. Another noticeable feature is the use of square-headed bolts, although hexagon nuts are most universally used.

In Fig. 2 is shown the internal sphere in several of its stages. It is a drop forging which is heat-treated so as to show from 170 to 228 by Brinell test, after which it is sandblasted. The first operation is to drill the hole in the stem, as at *A*, and next to rough-turn the flange and stem, as at *B*. The flange, stem and the step are then rough turned and the edge recessed and bored as shown at *C*. Then the four bolt holes are drilled, after which the recess for the bolt head is cut on a milling machine as can be seen at *D*. Then the bore and stem are finished after which the threads are milled on the end as shown at *E*. Turning the sphere is shown in Fig. 3, where the special attachment mounted on the lathe carriage may be seen. Fig. 3 also shows the large micrometer, set for measuring the diameter of the sphere, and some of the other gages used. This operation is followed by grinding the outside of the sphere in the fixture shown in Fig. 4.

The external control sphere is a bronze casting which is machined in the usual way, the final grinding of the internal spherical surface being shown in Fig. 5. The grinding is done on a Heald cylinder grinder after all the other machining operations have been finished. The bolts by which this sphere is fastened to the front torque tubes are recessed in the body and the space over the heads filled with white metal as can be seen at *A*. The white metal filling is machined at the same time the internal surface of the sphere is bored and is also ground with the bronze. The white metal filling effectually prevents the bolts from loosening and also adds to the bearing surface of the sphere.

The rear-axle housing consists of a differential case in halves having a tapered tube on each end to carry the brake rigging as well as the axle bearing. Since the

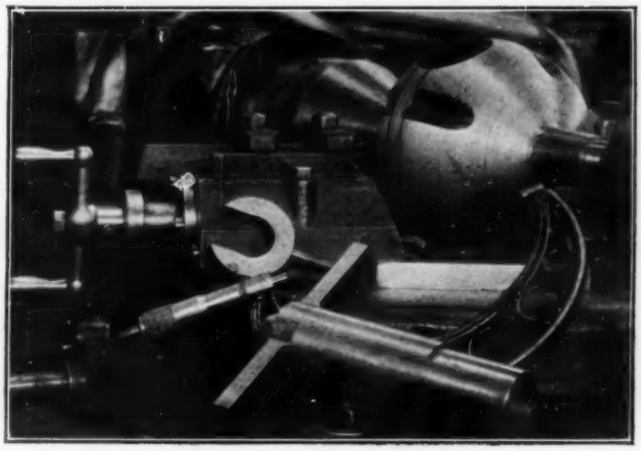


FIG. 3. TURNING OUTSIDE OF CONTROL SPHERE

FIG. 4. GRINDING THE INTERNAL CONTROL SPHERE

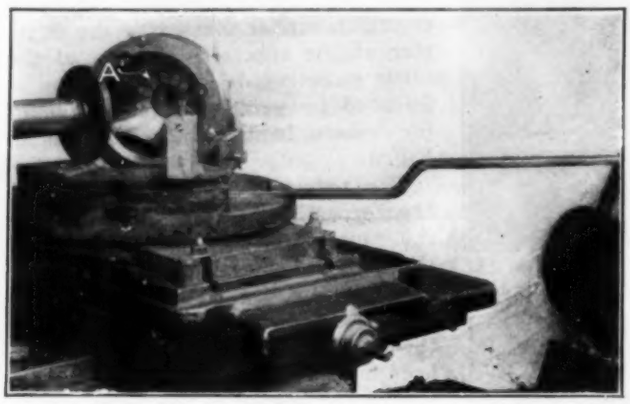


FIG. 5. GRINDING THE EXTERNAL CONTROL SPHERE

housing parts are all forgings, no castings or sheet-metal work enter into the construction of these essential parts of the car. Each torque tube is tapered and has a flange on each end for bolting it to its adjoining member.

These torque tube forgings are rough-turned and bored by the forge shop so that the first operation in the Rolls-Royce plant is to heat-treat them so they will test from 255 to 277 Brinell. They are then sandblasted and the test pieces examined for strength and quality, after which the flanges are turned and faced and the parallel portions of the outside turned.

The axle tubes are finish turned in the Lo-swing lathe as shown in Fig. 6. The tube is driven by the large end flange *A* by means of the bolts shown, the small end being supported by a suitable center. Multiple tooling is used, the taper turning being controlled by the former *B*. The former is fixed to the lathe and remains stationary while the tools travel along the incline guided by rollers as at *C*, which are kept in contact by suitable springs. This method gives the desired form to the tube and makes an economical and uniform method of machining the outside.

Boring the Taper

The inside of the axle tube is finished with a special boring bar similar to the one shown in Fig. 7. This particular bar is for the front portion of the torque tube, but the method of use is similar in both cases. After the flanges of the rear torque tube are turned and faced, three locating holes are next drilled in the small flange for handling the tube in the turning and boring operations. Boring the taper is shown in Fig. 7. Here the tube is centered by a chucking flange *A* and held in position by the three clamps shown. The bearing ring *B* runs in the jaws of the steady-rest and supports the outer end of the tube. Suitable pins in the driving plate *A* prevent the tube from slipping under the cut.

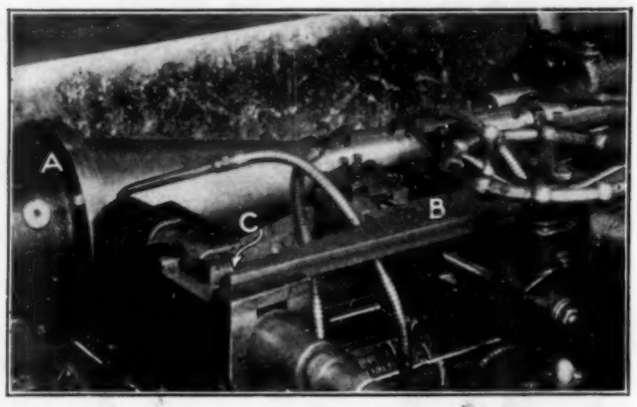


FIG. 6. TURNING A REAR-AXLE TUBE

The boring is done by a small toolblock mounted in the under side of the large tapered bar *C* and fed by suitable gearing from the lathe carriage mechanism on which the boring fixture is mounted. Motion is secured from the crossfeed, through suitable gearing to the shaft *D* which in turn drives the screw controlling the tool carrying block in the bar *C*. In operation the bar is run inside the tube to be bored a sufficient distance to give the desired amount of cut and the feed started. For increasing the depth of cut it is only necessary to move the carriage forward and lock it in a new position for the succeeding cuts.

It will be understood that the increase in the depth of the cut will be equal to the tangent of the taper angle of the boring bar multiplied by the longitudinal movement of the carriage.

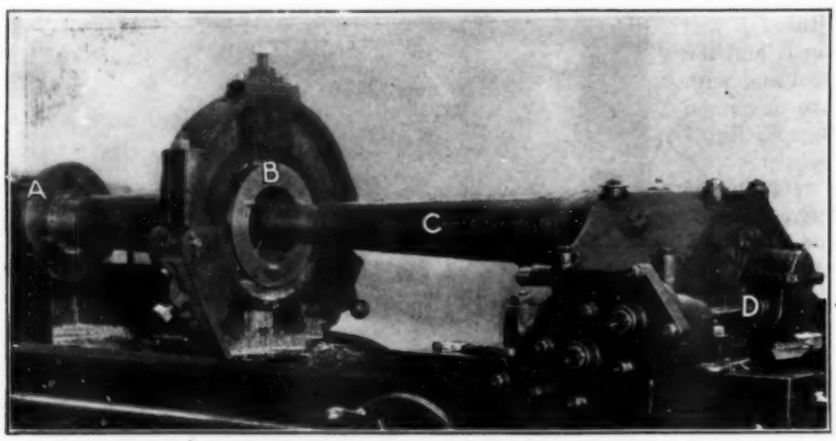


FIG. 7. BORING A TORQUE TUBE

Miscellaneous Railroad Shop Tools and Methods

An Excellent Method for Guiding Taps and Reamers—An Inexpensive High Speed Steel Reamer—Fixture for Plumbing Crankpins—Repairing a Cylinder

By FRANK A. STANLEY

AN INTERESTING set of taps and appliances used in connection with radial stay operations are illustrated by the line drawings herewith. Fig. 1 shows the taper reamer for crown sheets; the taper

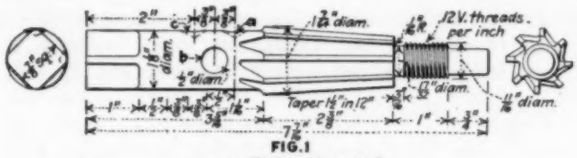


FIG. 1

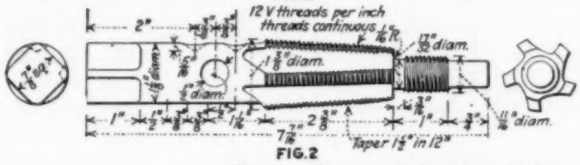


FIG. 2

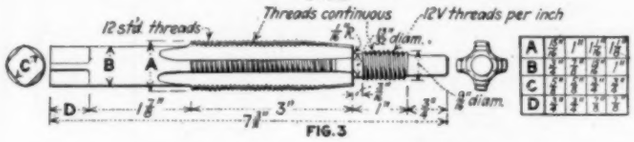


FIG. 3

FIG. 1. TAPER REAMER FOR CROWN SHEET. FIG. 2. TAPER TAP FOR CROWN SHEET. FIG. 3. TAPER TAP FOR OUTSIDE WRAPPER SHEET

tap for crown sheets is represented by Fig. 2. The taper tap in Fig. 3 is for the outside wrapper sheet. A stop gage for crown sheet reamer and tap is illustrated in Fig. 4. A handy split nut for quick action on tap extension guides is shown in Fig. 5; and a set of extension guides themselves are seen in Fig. 6.

The method of applying these tools in reaming and tapping is illustrated in Fig. 7.

Referring first to the crown sheet reamer Fig. 1: This tool will be seen to be provided with a pilot and threaded portion at the leading end and the shank is shown with three setscrew seats for three definite positions for the stop collar shown in Fig. 4. The three position holes are marked *a*, *b* and *c*, in Fig. 1, and there are three numbered positions stamped on the shank showing as 1, 2 and 3, the difference in stop gage position from one hole to the next being $\frac{3}{8}$ in.

If a new hole is being reamed out for tapping, the stop gage is placed in position No. 1, and when later on the work is repaired and re-reamed, instead of reaming out to an indefinite point, the stop gage is placed in position No. 2 and again the hole is reamed to an exact known diameter. When the hole is eventually reamed out for the third time, the stop gage is placed in position No. 3 for the final or largest hole that will be permitted in the work.

Thus the hole is reamed three times before it reaches its maximum allowable size. The position of the reamer in the sheet is shown at 1 in Fig. 7. The stop gage is shown in its first position and the pilot end of the reamer is shown entered into place in the extension guide *A*. There are three guides in the set, designated at *A*, *B* and *C* (see Fig. 6). The end of the reamer screws into the hole in the end of the extension, forming a solid firm joint, and as the body of the extension fits through the hole in the outer sheet, the alignment of the reamed hole with the crown sheet hole is thus assured.

Now consider the taper tapping operation following the reaming process: The tap is also provided with three positive positions for the stop gage and the application of the gage to the first position on the tap is seen clearly at 2 in Fig. 7. The use of the extension guide *A* is here again seen, tap and guide extension being coupled in the same manner as the reamer and guide.

Bushing an Enlarged Hole

It will be noticed that the extension is shown passing through a bushing in the outer sheet. This is included to show the method of bushing down an enlarged

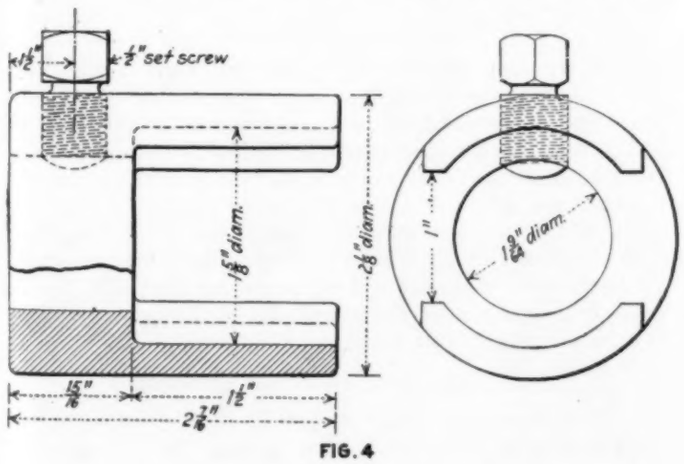


FIG. 4

FIG. 4. STOP GAGE FOR REAMER TAP.

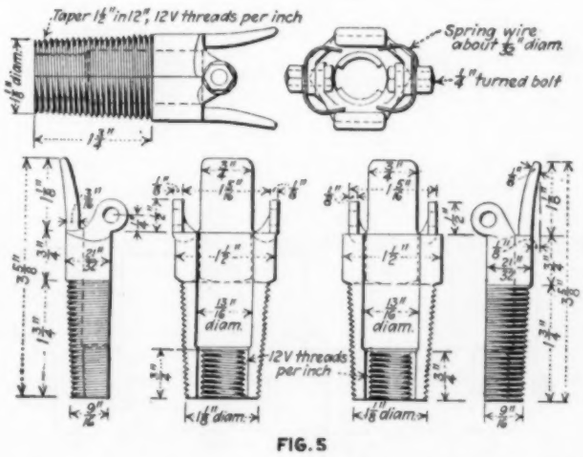


FIG. 5

FIG. 5. SPLIT NU T FOR TAP EXTENSION GUIDE

hole. The largest stay used is 1½ in. and the largest bushing permissible is 1¼ in. In bushing a hole as in No. 2, Fig. 7, the bushing is made of the same taper as the tap and screwed in to stay. Then the

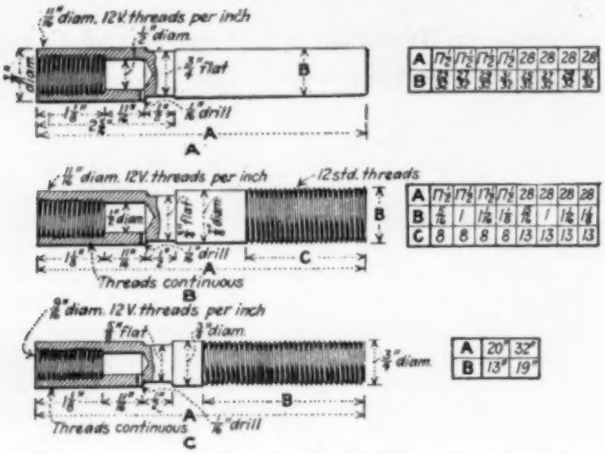


FIG. 6. TAP AND REAMER EXTENSION GUIDES

reamer guide can be used through the bushing as though it were the original hole, and the bushing tapped the same way. In tapping the wrapper or outside sheet, the tap used has a Whitworth thread as noted in Fig. 3, and if a hole in the sheet is bushed as referred to above, the bushing is also threaded Whitworth standard. This form of thread gives a greater area and stronger section between adjacent holes in the sheet than is possible with other forms of thread.

The threads on the tap and on the pilot for connecting with the extension guide are continuous. Thus, when either tap is used as in positions Nos. 3 or 4, Fig. 7, with a threaded extension guide, as guide *C* or *B*, perfect continuity of threads is assured between the tapped holes in the two sheets.

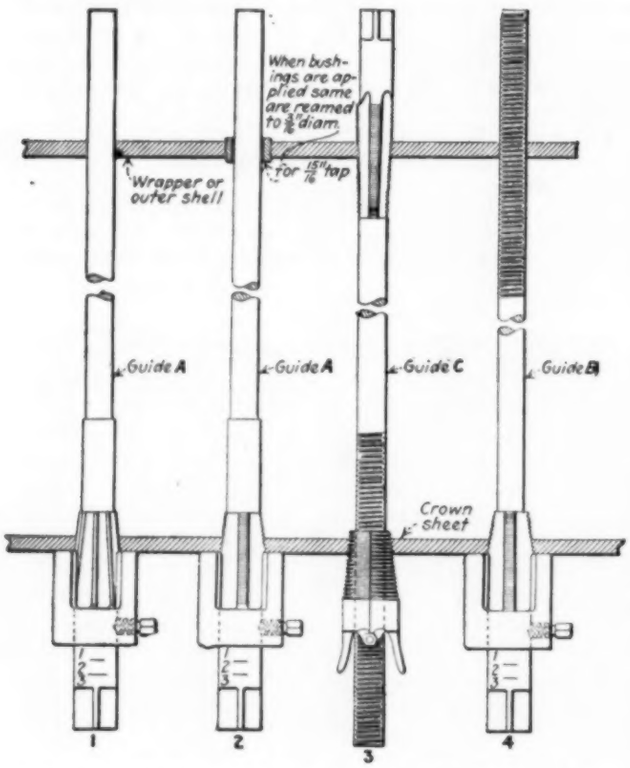


FIG. 7. METHOD OF REAMING AND TAPPING HOLES

Application No. 3 in Fig. 7 shows the method of tapping the outer shell after the crown sheet has been tapped, in which the split nut for the tap extension guide is used. To secure continuity of threads between the hole to be tapped and the hole already tapped the following method is applied:

The split nut, Fig. 5, is made with outside and inside threads even. The two parts of the nut are pivoted on two short studs and normally held closed by means of two torsion springs. In applying the nut as in Fig. 7 (see No. 3 position), the nut is opened by the pressure of the fingers on the projecting ears behind the pivot and slipped on over the tap extension guide *C*, which has been passed through the holes in the crown and outer sheets. After reaching the tapped hole in the crown sheet the nut is allowed to close on the thread on the extension guide and is then screwed into the tapped hole as seen at No. 3, Fig. 7.

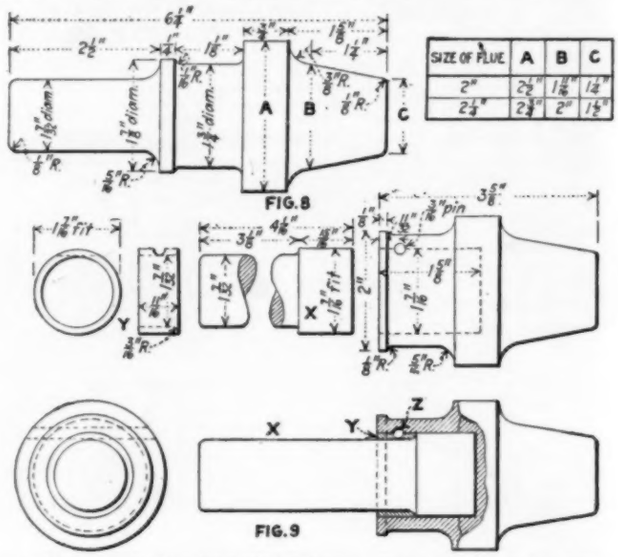


FIG. 8. SOLID BELLING TOOL. FIG. 9. ASSEMBLED BELLING TOOL

The tap for the outer shell is then screwed into the other end of the extension guide and this brings its threads into correct relation to the threaded guide end in the nut in the crown sheet. The hole in the outer sheet is now tapped out, the threaded guide extension *C* serving as a lead screw to help pull the tap into the work and at the same time assure continuous threads between the two sheets.

Tapping the Crown Sheet

If the hole in the outer shell has been tapped first and a hole is to be tapped in the crown sheet, the method of application is as represented at No. 4, Fig. 7. For this process extension guide *B* is used. The taper tap for the crown sheet is screwed into the extension guide and the stop gage applied to the tap as at No. 4. The threaded end of the extension guide *B* is already run into the tapped hole in the outer sheet, and serves as a lead screw so that the thread in the crown sheet hole will be continuous with the thread in the outer sheet hole.

Belling Tools for Flues

The drawings, Figs. 8 and 9, show two forms of belling tools used for bell-mouthing flue ends before beading. The original construction of the tool is represented by Fig. 8. This is a solid one-piece affair

made of tool steel. After this tool has been used for a time it may break in the shank at a point just behind the head, and the method then is to fit up the old head with a new shank according to the drawing in Fig. 9. This head is bored out to receive the enlarged end of a new shank *X*, which is held in place by a soft steel bushing *Y* which is pushed in behind the shoulder on the shank. The bushing is further secured by a small crosspin *Z* in a hole drilled half in the bushing and half in the belling head.

Complete dimensions are given on the detail drawings for both the solid belling tool and the built up construction which constitutes the replacement form.

Inserted Blade Reamers

Two inexpensive reamers with inserted blades of high-speed steel are illustrated in the halftone, Fig. 10. These reamers are made in various sizes but on the same principle of construction, namely, with bodies of machine steel milled with slots of suitable width to receive standard thickness of high-speed steel stock. The high-speed steel bars are ground on the sides just enough to clean up, cut into lengths for the reamer blades, and these blades are then driven into the slots in the reamer body. Then the reamer is ground to size and the blades relieved as desired.

A shallow half-round groove is milled at the front of every slot before driving the blades in, allowing chip space and at the same time allowing the reamer blades to be set in deeply where they will be properly backed up.

Valve Setting Frame

One form of frame for setting valves is shown in Fig. 11. This device is applied particularly to Walschaert's valve gear, but similar constructions are used for other forms of gearing.

The frame consists of a telescopic arrangement made up of light but stiff bars of metal which may be extended or contracted for adjustment as required. The outer ends of the members are provided with bearing bushings and plugs to allow the device to be hung up on crankpin and valve gear connection, thus taking the place of the actual gear itself. So, if an engine on the floor has the side motion and gearing stripped down but is otherwise ready for valve setting, this dummy device can be applied and the work of setting valves carried along without waiting for the gear to be put in place.

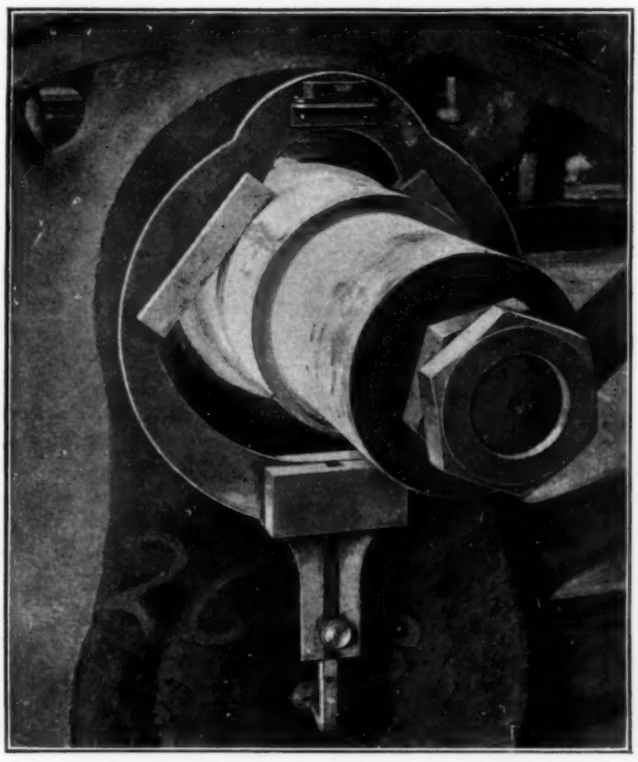


FIG. 12. FIXTURE FOR PLUMBING CRANKPINS

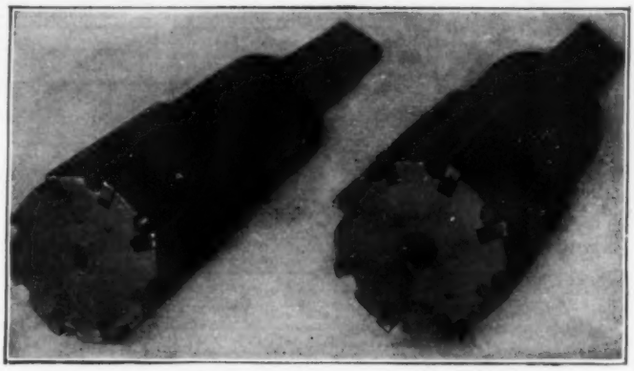


FIG. 10. ROSE BIT REAMERS WITH H. S. STEEL BLADES

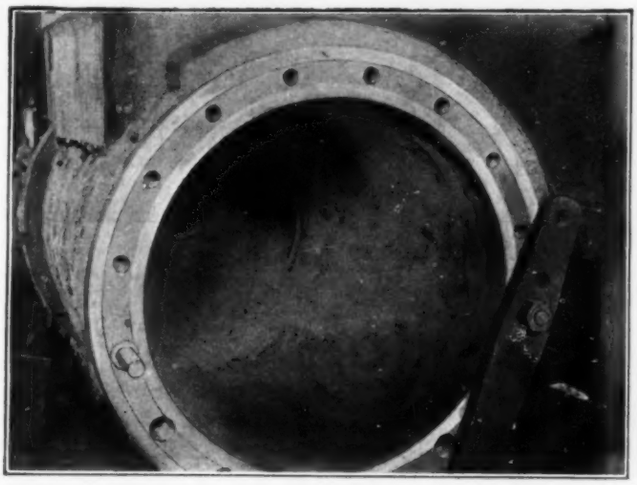


FIG. 13. CYLINDER REPAIRED BY OXYACETYLENE WELDING

Fixture for Plumbing Crankpins

An interesting tool which is used in connection with eccentric keyway work in axles is shown in Fig. 12. This is a fixture for plumbing crankpins and is used for obtaining the positions of eccentric keyways before the driving wheels are placed under the engine.

The device can be used in connection with any size of driver and crankpin. It consists of a frame with an arm at the bottom into which is fitted a sliding pointer which may be adjusted along the center line according to the different distances from crankpin to wheel center. The frame carries two steel straight-edges or jaws which are accurately fixed at right angles to each other. On the center line bisecting the angle formed between the two steel straight-edges a small spirit level is attached.

In use, the driving wheel is rolled over until the crankpin is approximately in line vertically over the wheel center, then the plumbing device is applied as

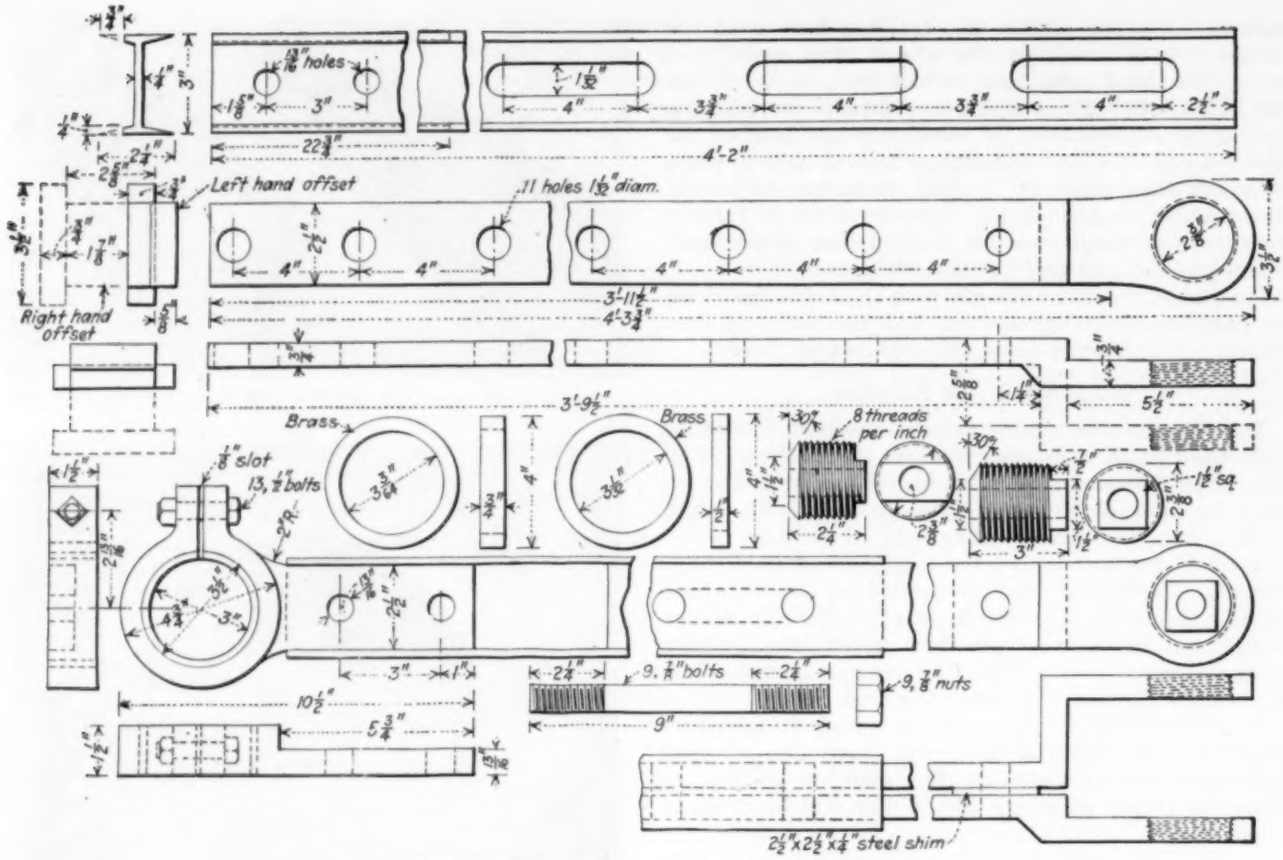


FIG. 11. FRAME FOR SETTING WALSCHAERT VALVE GEAR

shown. The lower pointer in the groove in the arm is slid endwise until it enters the center punch in the wheel center and is then clamped by the small knurled screw. The wheels are then rolled slightly either way until the bulb in the spirit level shows that the pin is plumb over the wheel center. Then a center device and level are applied at the inside on the axle and with the addition of a templet for giving allowance for advance, etc., the keyways are quickly and accurately laid off for cutting for the eccentrics.

COMPOSITION OF BEARING METALS AND SOLDERS—LOCAL USE—S. P. CO.—PACIFIC SYSTEM

Item	Use	Component Metals	Desired Composition, per Cent	Shop Limits in Composition, per Cent
		Hard Babbitt		
1	Crossheads and eccentric straps	Lead	62.4	60.0 to 64.0
		Tin	21.4	20.0 to 22.0
		Antimony	15.6	13.0 to 17.0
		Copper	0.6	0.5 to 1.0
		Lining Metal		
3	All locomotive work, other than Item 1, including driver, engine truck, and trailer bearings. Packing rings for saturated steam. Relining all car and tender bearings	Lead	85.0	83.0 to 87.0
		Antimony	10.0	8.0 to 12.0
		Tin	5.0	4.0 to 6.0
4	Metallic packing rings for superheated steam	Lead	50.0	48.0 to 52.0
		Copper	50.0	48.0 to 52.0
		Armature Babbitt		
5	On steamers	Tin	85.58	84.0 to 86.0
		Antimony	8.64	8.0 to 10.0
		Copper	5.78	5.0 to 7.0
		Solder No. 1		
6	Locomotive, machine and tin shop work, etc	Lead	50.0	48.0 to 52.0
		Tin	50.0	48.0 to 52.0
		Solder No. 3		
7	Wiping joints and plumber's work	Lead	60.0	58.0 to 62.0
		Tin	40.0	38.0 to 42.0

The locomotive cylinder shown in Fig. 13 was broken at a point inside the flange, the casting being broken out for a width of several inches and the break extending between a third and a half way round the bore. The repair was successfully made by the oxyacetylene process and the cylinder rebored and returned to service with a net saving of at least $750 over the cost of a new cylinder.

The bolt and strap used to pull the flange up into position and hold it during the welding are shown at the front of the photograph. It is customary in such work to use bolts or rods and clamps wherever required to restore the work to its original place, and if it is to be preheated, as is generally the case, a brick furnace is built up around the job and the heat kept up until several hours after the completion of the welding, to prevent cracking in the weld.

The table gives the formulas used by the Southern Pacific Co. for bearing metal compositions for crossheads, eccentric straps, bearings, packing rings and so on.

The tools and methods illustrated in this article are all from the Sacramento shops of the company.

The HIGH and LOW BAY TYPE of MACHINE SHOP

By Fred H. Colvin
EDITOR, AMERICAN MACHINIST

Wide, High Bays, with Low Bays Between, Give Light from Both Sides—Standard Columns and Shapes Make Rearrangement Easy at Any Time—Excellent Artificial Lighting

BY F. H. COLVIN
Editor, *American Machinist*

THE building of a shop is perhaps the most important step in any manufacturing business. On its location and arrangement depend many factors affecting the cost of production. And once built it becomes an investment which can seldom be shifted without considerable financial loss. For these reasons it is of the utmost importance to consider carefully the location with regard to receiving and shipping material, the accessibility to a desirable supply of labor and the probable growth of the community.

Next comes the type of building to be erected, and here, of course, the decision must depend largely on both the location of the ground and the nature of the product. The details will, however, be modified by the grade of the property, the proximity and location of connecting railroad spurs and the ideas of the owner or engineer. For the architect, in the old sense, has no place in modern shop building, unless to make it a bit more ornamental than has been done in the past. But he should not be allowed to interfere with the engineering details or to restrict window lighting because of some fancied architectural effect in the style of a bygone period. The storage warehouse effect can be avoided without sacrificing light and other desirable features.

Perhaps the most important decision is whether to use a single-story or a multi-story building. This decision is affected at times by the location of the land, both as to its restricted area and its price. Both types have their advocates and the kind of machines built make less difference as to choice than might be supposed. For we find heavy machinery built in multi-story shops as well as in shops with a single floor, and modern construction of either steel or concrete makes possible the use of heavy machinery above the ground floor.

Taking the single-story shop first, we shall show several types. These will be different and yet all have points to be considered. The first is that of the Foote-Burt Co., of Cleveland, Ohio.

In deciding on the type of construction for the new shop building, the Foote-Burt Co. was influenced by the experience of the president, George E. Randles, in connection with his activities in the building of motor-vehicle shops for the Army during the war. The shop portion of the building consists of six bays, three

FIG. 1. ONE OF THE HIGH BAYS

high bays 58 ft. wide and three narrow bays 20 ft. wide, alternating so as to give the effect of huge monitors, the lighting being secured by windows where the high bays rise above the low-bay roofs. The

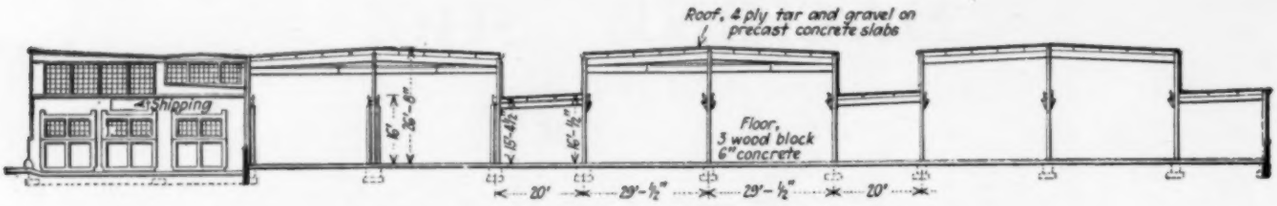


FIG. 2. A CROSS-SECTION OF THE BUILDING

appearance of this construction in the high bays, and the excellent lighting secured, can be seen in Fig. 1. As the high bays are 26 ft. in height and the low bays 16 ft., this gives large window area distributed the whole length of the shop. Details of this construction can be seen in Fig. 2.

The high bays may be called double, as they have a supporting column in the center, but in both the high and low bays, care has been taken to utilize standard steel so that the building is in reality made up from standard material, with regular lengths, all special design and construction being carefully avoided. The

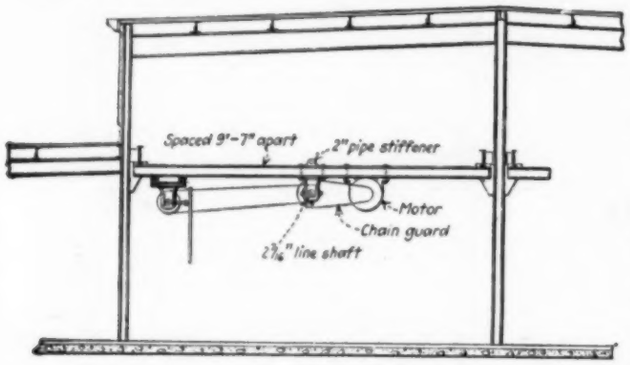


FIG. 3. DETAILS OF A HIGH BAY

shipping department is shown at the left of Fig. 2, being at the extreme end of this bay, as will be seen later in the plan view of the shop.

Fig. 1, which is a section of the planer department, shows very clearly the type of column used, the way in which the crane runways are supported, as well as the simple standardized construction used for supporting countershafts under the crane runways. This also shows the roof construction, the arrangement of electric lights and sprinkler heads, as well as the distribution of some of the heavier machinery.

As can be seen in Fig. 2, the roof of the wide bay pitches slightly in both directions from the center, while the low bay has a pitch of 8 in. in 20 ft., bringing the drainage down through suitable piping beside the building columns. The height of the craneway is 16 ft. from the floor, which is of 3-in. wood blocks laid on a 6-in. base of concrete. The roof consists of precast concrete slabs laid on the longitudinal beams, the outside being covered with a four-ply tar and gravel roof coating.

Wherever it has been found desirable to place machine departments in the high bays, both line and countershaft supports have been provided by channels fastened under the crane runways, as in Fig. 3. These channels are 10 in., two placed back to back and 1⅛ in. apart to allow holding bolts to be easily dropped between them if necessary. These double beams are spaced 9 ft. 7 in. apart, this being the distance between hangers. Countershafts are supported at either end of these beams in a suitable position over the machine to be driven. The countershaft supports are 6-in. channels, back to back, with 1-in. separation.

The Line-Shaft Drive

Each line shaft is driven by a suitable motor, also mounted on the large channels and driving the shafting by means of a silent chain which is inclosed in an oil-tight case. The line shafting is 2 7/16 in. in diameter and driven at 200 r.p.m. for cone-pulley driven machines and 350 r.p.m. where single-pulley drives are in use. Various sizes of motors are used, these ranging in five sizes, 10, 15, 20, 25 and 30 horsepower.

Further details concerning the shafting supports are shown in Fig. 4, which shows the line shaft supported at the center of each side of the high bays, the way in which the countershaft supports are hung, and the pipe bracing *A* which runs parallel to the shafting along the upper side of the long beam. This acts as a stiffener.

All the countershaft supports are standardized and is an easy matter to re-arrange machinery in any department or to materially alter the layout of the different departments should future development of the business make it seem advantageous to do so. Fig. 4 also shows one of the inclosed motor drives at *B* the motor itself being at *C*, almost hidden behind the

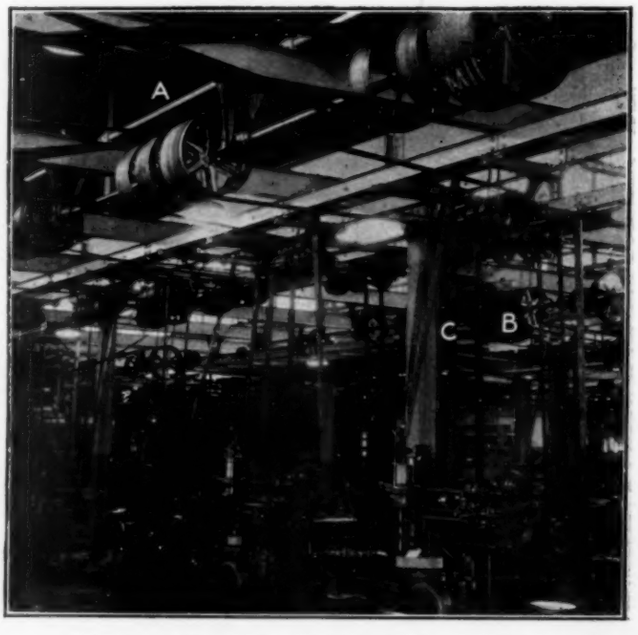


FIG. 4. LINE AND COUNTERSHAFT DRIVES

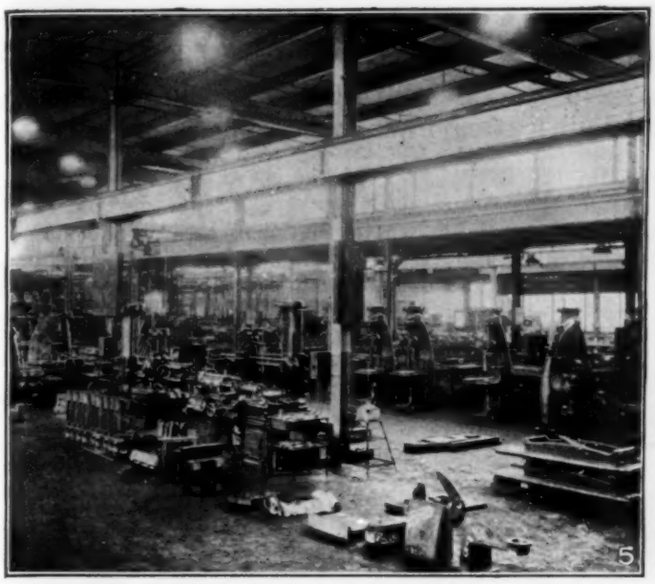


FIG. 5. HOW THE SHOP LIGHTS UP AT NIGHT. FIG. 6. THE DRAFTING ROOM

supporting column. The view shows a portion of the gear-cutting department and gives a good idea of the way in which both the natural and artificial lighting is accomplished.

This standardization has been carried out throughout the shop, every column being alike and every column punched for crane girders whether they are in position or not. The same size channels and the same length girders equally spaced make a very flexible design and one which should be carefully considered.

The Artificial Lighting

The artificial lighting of the plant has also had careful study. Mazda lamps of 300-watt capacity in standard RLM reflectors are used in all manufacturing space. This figures out to 1.3 watts per square foot of floor space with an intensity of 8½ foot-candles. The shop lights are 21 ft. 6 in. from the floor in the high bay and 12 ft. 6 in. in the low bay and are so distributed as to equalize the distribution of light to the bays. Fig. 5 was taken at night, entirely by artificial lighting.

The lighting of the drawing room is by the indirect method as can be seen in Fig. 6. Here the lamps are of such size as to give 2.7 watts per square foot, more light being necessary in the indirect system. The lighting in both Figs. 5 and 6 is, however, remarkably clear from shadows, which is highly desirable in both drafting room and shop. It should be noted in this connection that the drafting room is over 230 ft. long and accommodates 100 men.

Two washrooms are provided, these being located in one of the low bays and occupying, with the toilets above, the entire height of the bay. Fig. 7 shows the neat arrangement of these washrooms, with their cement flooring and white enameled sinks and racks.

The sinks are supported on pedestals instead of spreading legs, which are always in the way, and it will also be noted that all the water pipings above the sinks are neatly inclosed by an enameled channel which completely hides the pipes and presents an appearance which is not only neat but is easily kept clean. A drinking fountain is also provided here as well as at other points.

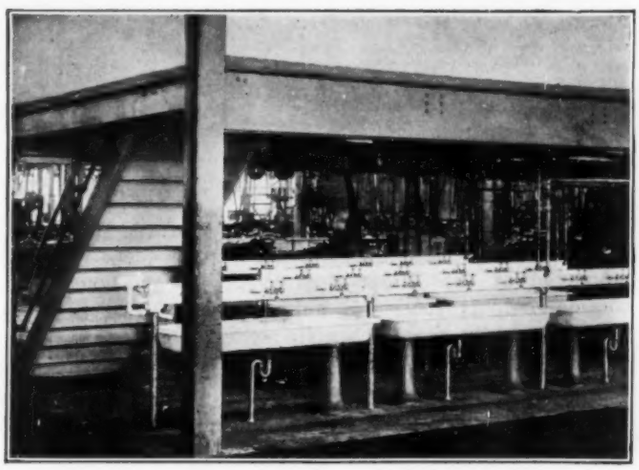
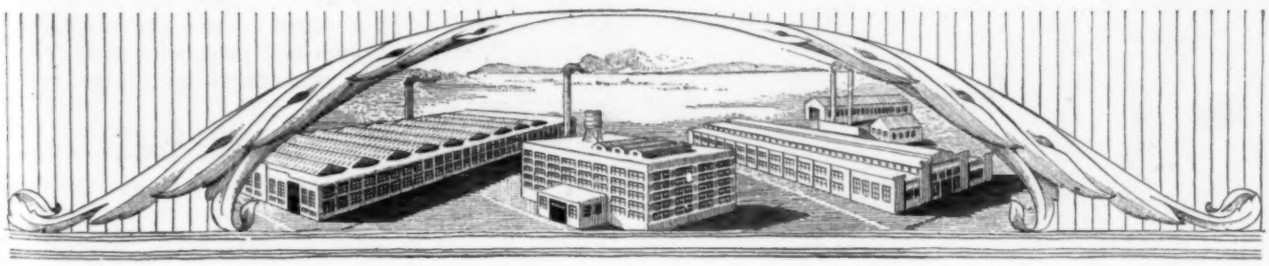


FIG. 7. ONE OF THE WASHROOMS

A second article will deal with the layout of the shop and methods of handling material from department to department.



Caring for Tools at Puget Sound Navy Yard

A Well Equipped Central Tool-Grinding Room—Novel System of Sliding Racks for Storing Milling Cutters—Cleansing and Lubricating Pneumatic Tools

SPECIAL CORRESPONDENCE

WITH the great diversity of work to be done in a Navy Yard handling all classes of vessels, as well as other work, it is necessary to have a large variety of both special and regular tools of various kinds. These tools, however, lose much of their value unless they are properly cared for and are so stored as to be easily found when wanted. The methods employed at the Puget Sound Navy Yard are to be commended, as tools are not only well cared for but they are easily accessible whenever they are needed.

There is provided a central tool-grinding room for cutters, reamers and all tools of that type. A corner of this room is shown in Fig. 1. As can be seen, it is well equipped with machinery for this kind of work, including the grinding machine for sharpening cutting-off saws, which can be seen in the center of the illustration.

FIG. 1. THE CENTRAL TOOL-GRINDING ROOM

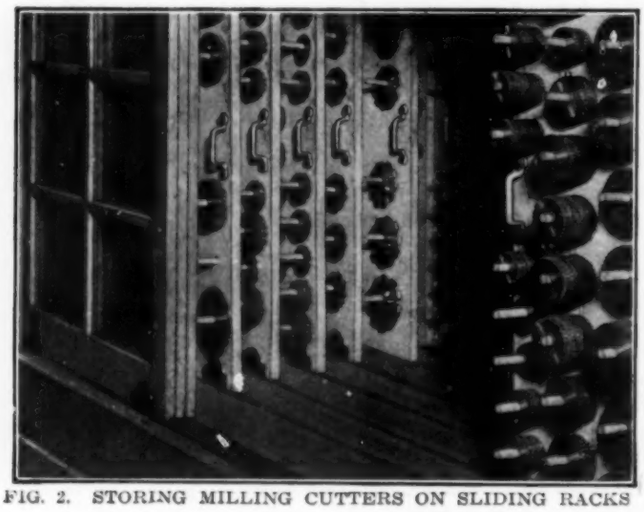


FIG. 2. STORING MILLING CUTTERS ON SLIDING RACKS

The cabinet shown in Fig. 2 illustrates one method of storing cutters. It consists of a number of sliding racks, properly indexed and protected by glass doors to keep out the dirt and dust. Being mounted on good rollers the racks are easily moved and the plan makes possible the storage of a large number of cutters in a small space.

Another type of storage rack is shown in Fig. 3, being for collets, centers and small jigs and fixtures. The latter are for the most part kept in the boxes shown in the bins below the numbered trays, each box serving to keep a jig and all its attachments together, so that the whole thing can be issued at once.

Tools, such as drills, reamers and counterbores, are kept in the racks shown in Fig. 4. There is nothing unusual about these racks but they are conveniently arranged and the tools can be easily found. The rack at *A* enables cutter arbors and similar tools to be kept where they are convenient. This view also shows some of the hollow gages for pipe threads at *B*. This room is known as the tool-issuing room.

Bolts, clamps, blocks and angle plates are stored as shown in Fig. 5. This view shows a considerable variety of shop furniture for various machines, including V-blocks, angular work tables as at *A*, and adjustable angle plates at *B*. There are collars of various sizes at *C;* clamping jaws for planer and similar work at *D;* lathe dogs at *E;* turn-buckles for various purposes at *F*, and both eye- and hook-bolts at *G*. These appliances are kept in a convenient quarter and can be easily issued on demand.

Caring for Pneumatic Tools

In too many places pneumatic tools are sadly neglected. They are not only abused by the users, but little or no care is taken of them in the toolroom and

as a result they are short-lived and fail to give the satisfaction they should during their existence. One instance is told by a builder of pneumatic tools who endeavored to lighten his product by using an aluminum casting for the main frame. No difficulty was experienced until in one case, he found the thin aluminum shell worn through from dragging instead of carrying the tool over steamship decks with their rivets and projection.

In the Puget Sound Navy Yard, however, pneumatic tools are very carefully cared for, the oil service station shown in Fig. 6, being provided especially for this purpose. All pneumatic tools, whether chipping hammers or rotary motors, for drilling or other work, are kept in better shape with thorough inspection and oiling.

Suitable oil tanks, in combination with benches, are provided at *A*. Here the tools can be soaked in kerosene or any cleansing compound which may be preferred and, after being thoroughly cleaned, they can go into the next tank which contains lubricating oil. Here they are thorougly soaked so that all parts will be perfectly lubricated. Air-hose connections are provided so that the tools can be operated after coming out of the oil bath, the funnel *B* being provided to catch the surplus oil. Bearings which require grease are filled from the grease press *C*.

Adjoining the washing and oiling room are the racks for the pneumatic tools, as shown in Fig. 7. These racks are substantially built, thoroughly braced by the tie rods shown, and have simple but substantial hooks for supporting the various tools. The hooks consist of what may be called headless bolts or studs, threaded on one end and bent to the shape shown. They are supported in the flanges of the angle-iron uprights by a nut on each side of the plate. This makes a very substantial form of rack on which the tools are easily accessible and which supports them where they are out of the way until wanted as may be readily seen on examination of the illustration.

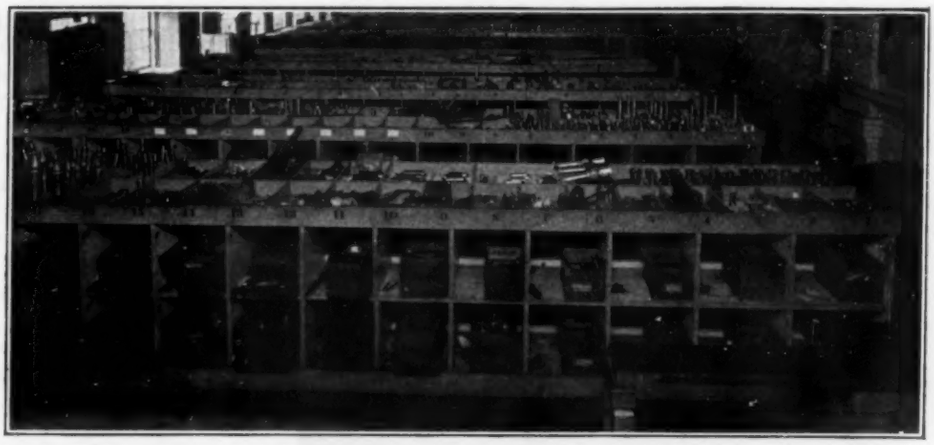


FIG. 3. WHERE JIGS AND FIXTURES ARE STORED

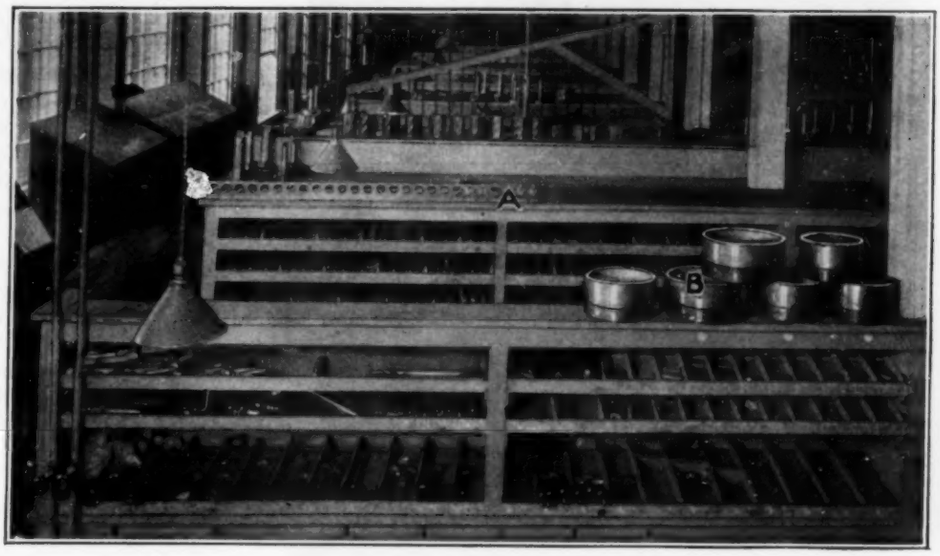


FIG. 4. A SECTION OF THE TOOL-ISSUING ROOM

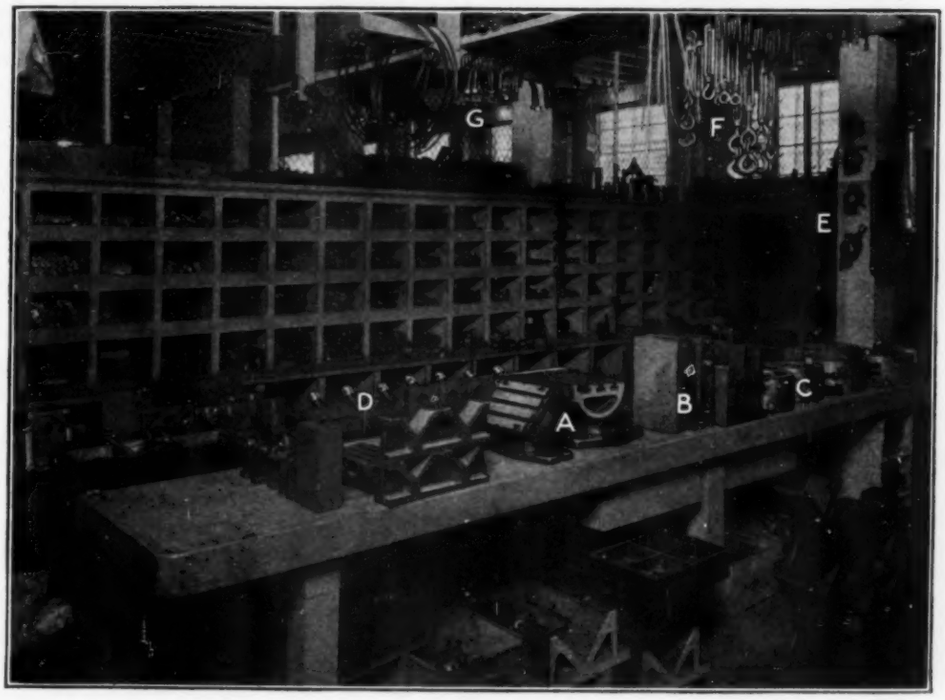


FIG. 5. BOLT, CLAMP AND ANGLE BLOCK STORAGE

FIG. 6. PNEUMATIC TOOL SERVICE STATION

FIG. 7. RACKS FOR PNEUMATIC TOOL STORAGE

By the use of such methods of cleaning and storing pneumatic tools the danger of out of order tools being issued for use is obviated or at least lessened.

Service Given to Purchasers

By John Mark May

Manufacturers of machinery seem to be more inclined as time goes on to follow their product to the setting-up and using stage, that they may be sure that it is started under the most favorable conditions. They feel that a first impression of a new machine, if unfavorable, even though later developments may indicate that a reversal of the first decision is due, has injured the reputation of the machine to a certain extent, and that the impression is slow to wear off. Whereas, if the machine starts off right and makes a favorable first impression, much will be overlooked because of the fact that it did do satisfactory work at the start, and because later developments are more likely to have been due to the manner of operating the machine rather than to the machine proper.

There are some manufacturers, mostly of small machines, who notify their purchasers that the machine has been tested and adjusted before leaving the factory and request them not to make any adjustments or changes; but, if the machine is not satisfactory in every respect, to either notify them at once or return it to the factory for examination and replacement.

Some other manufacturers feel justified in furnishing a very thorough set of instructions gotten up in attractive and durable form. The book which the Jones & Lamson Co. furnishes with its flat turret lathe is a notable example, as it not only gives all instructions that are likely to be needed, but also gives the operator an insight on principles, economics, and ethics, as well.

S. O. Livingston's article on page 237, Vol. 54, of the *American Machinist*, entitled "The Cost of Unnecessary Service," reminds me of a typical case which came under my observation.

A certain machine was purchased and set up according to the instructions which came with it. It started off fairly well; but very soon began to fall short of what was expected of it and grew gradually worse until, when about two weeks had elapsed, it had gotten to a point where it was delivering only about 75 per cent of its capacity. The machine, when running satisfactorily seemed to be superior to another type of machine which it had replaced; and the purchaser, very anxious to know at once if it could be depended upon, at this time wrote the manufacturer to send a representative at once.

Practical and Efficient Diplomacy

The manufacturer wrote immediately in effect that, there being no representative free to send, either from the home office or on the road within a reasonable distance from the purchaser's plant, he was writing them fully about certain adjustments that were sometimes needed under similar working conditions, citing other adjustments that should be made under certain unusual conditions. He asked that he be informed a little more fully as to the details of the troubles encountered, stating further that if, after the suggested adjustments had been made, their troubles were not entirely overcome, he would be very glad to send a representative to go into the matter more thoroughly and do whatever was required to give them the service, even to replacing the machine if found necessary. The adjustments were made as outlined, and the machine afterward made a satisfactory performance.

It seems to the writer that this case was handled in a diplomatic, practical, economical and satisfactory manner, as it answered every requirement of the case involved and developed a well-satisfied customer.

The purchasers of machinery should understand that every dollar of extra expense that they put upon the manufacturer, they, the purchasers, must eventually pay, perhaps indirectly. It may extend over a considerable period of time, but nevertheless they must eventually settle the bill. With such an understanding in the minds of purchasers, unnecessary expenses along these lines should be materially reduced, to the mutual benefit of both parties—not only reducing unnecessary expense, but worry as well.

Manufacturing with Special Machines vs. Standard Equipment

II. The Forgings and Some of the Tools Used in Machining Them—Details of Boring and Milling Cutters—Difficulties Encountered and Overcome

By COLONEL G. F. JENKS* and M. H. CHRISTOPHERSON†

THE sleigh forgings shown in Figs. 2 and 3 were made by the Carnegie Steel Co., at the Munhall, Pa., works. Chemical and physical tests on the forgings were made at the same plant.

From April 24, 1918, to Jan. 8, 1919, the following forgings were received: 149 forgings of chrome-nickel steel, of which 120 were formed as per sketch *A* and twenty-nine were formed as per sketch *B;* 237 forgings of carbon steel, of which 135 were formed as per sketch *A* and 102 were formed as per sketch *B*.

The Carnegie Steel Co., rough planed: Forty-four sleigh forgings, fifteen of chrome-nickel steel, twenty-

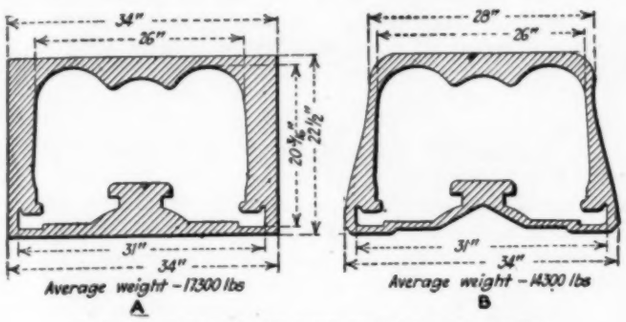


FIG. 2. DIMENSIONS OF SLEIGH FORGINGS

nine of carbon steel; two chrome-nickel steel sleighs developed forging defects in various stages of machining; three chrome-nickel steel sleighs developed forging defects in the hydrostatic test after being fully machined; six carbon steel sleighs developed forging defects in various stages of machining; one carbon steel sleigh developed forging defects in the hydrostatic test after being fully machined.

Operation 1

Face milling both sides of sleigh forging preparatory for finish milling edges in Operation 3, and for finish planing both sides to angle preparatory for Operation 16 is shown in Fig. 4.

In Operation 1 it was necessary to reduce both sides, full width of the sleigh from the rough to within ¼ in. of finished size, removing from forging A about 3,575 lb. The great amount of metal to be removed was due to difficulty and delay in preparing the forming dies from which the forgings B were finally made. Setting and removing sleigh, time 1 hour. On sleigh A (alloy steel) machining time, 7 hr. 40 min.; table feed, 15 in. per hour = 0.0625 in. each revolution of spindle; peripheral speed of 29-in. diameter cutters, 30 ft. per minute. No record of time for this operation at the arsenal.

Experience proved that B sleighs of carbon steel could be machined at the rate of 22½ in. per hour, making machining time 5 hours. Very few B sleighs were machined, so the feed was continued at 15 in. per hour.

When machining alloy forgings, it was necessary, on an average, to replace four cutters in each head after machining each sleigh. The tools were ground in the toolcrib on a Gisholt tool grinder. Various kinds of tool steels were used as it was customary to regrind broken planer tools for this work.

A heavy flow of cutting compound was maintained on the cutters through ¾-in. pipe at 80 lb. pressure.

Four Otis type-4 machines were supplied but only two were put into operation owing to signing of the armistice.

In machining forgings A the machine removed from 500 to 600 lb. of metal hourly. The machine with its worm gear and internal gear drive, having a combined reduction ratio of 200 to 1, required only 35 hp. when removing 600 lb of metal per hour from alloy forgings.

Fig. 5 shows the cutter heads with arrangement and shape of cutting tools. The cutter set-up is well adapted for rough machining heavy forgings where much tonnage of exceess metal is to be removed. The machine with its cutter heads is really a constant feed rotary planer with a number of planer tools set in series of four, the forward cutters are set to suit the irregularity of the rough forging and each succeeding cutter in the series is set so it will remove its share of the required depth of cut, the fourth cutter being set to the full depth of cut.

Operation 2

Planing top of sleigh from the rough to within ¼ in. of final size preparatory for finish milling in Operation 3, is shown in Fig. 6. Two remodeled planers, with tool clappers operated by air cylinders to prevent tools dragging on return stroke, were used and two sleighs were set tandem in rugged holding fixtures. A Cincinnati standard 42 in. x 10 ft. planer was used a portion of the time on the work. Setting and removing time average on each sleigh, 40 minutes. Machining time average on each sleigh, 4 hours. No record of time for this operation at the arsenal.

For carbon forgings the planer cutting speed was 38½ ft. per minute though it was necessary to reduce this to 26 ft. per minute when machining alloy forgings.

Red cut and Clarite high-speed steels 1¼ in. square were used on this work with a liberal supply of cutting compound. It was originally planned to finish plane the top and edges of the sleigh and some were machined in that way. Additional output required more capacity, and from experience in other milling operations it was decided to finish mill as shown in Operation 3. This method gave very satisfactory results both in time saving and accuracy.

Operation 3

Finish milling the top and edges of the sleigh is shown in Fig. 7. These surfaces were used to set the sleigh in the fixtures on various succeeding operations,

*Chief of Artillery Division, Ordnance Bureau, U. S. A.
†General Works Manager, Otis Elevator Co.

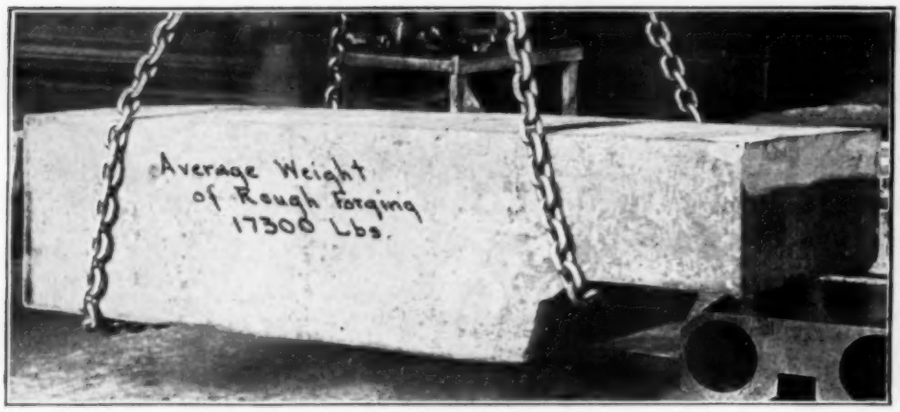


FIG. 3. ONE OF THE ROUGH FORGINGS. FIG. 4. A LARGE ROTARY PLANER

consequently it was important that they be finished smooth, parallel and uniform in width. The less frequent setting of cutting tools in the milling heads insured more reliable workmanship and also resulted in saving of several hours on each sleigh. One Otis type-6

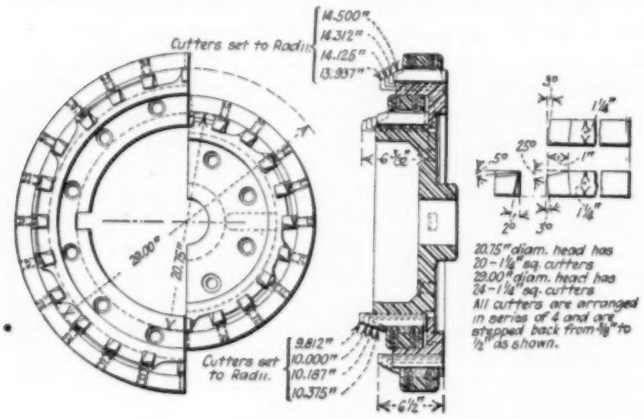


FIG. 5. DETAILS OF ROTARY CUTTER

machine was widened out for this purpose by inserting a filling-in piece between the bed and outboard bearing stand.

Setting and removing time, 40 min.; machining time, 5 hr. 45 min.; table feed 20 in. per hour = 0.035 in. each revolution of spindle; peripheral speed of 16⅝-in. cutter, 36½ ft. per minute; revolutions of cutter arbor, 8½ per minute. No record of time for this operation at the arsenal. The cutter heads were of forged steel with inserted high-speed steel cutters. Chip breaking grooves were ground on the cutting surfaces of each cutter to prevent chatter. The grooves were staggered so that the cutters left perfectly smooth surfaces. The cutters did continuous work 20 hr. daily for three weeks without regrinding; in the interval between grinding a large oil stone was satisfactorily used for stoning the cutters while in place.

OPERATION 4

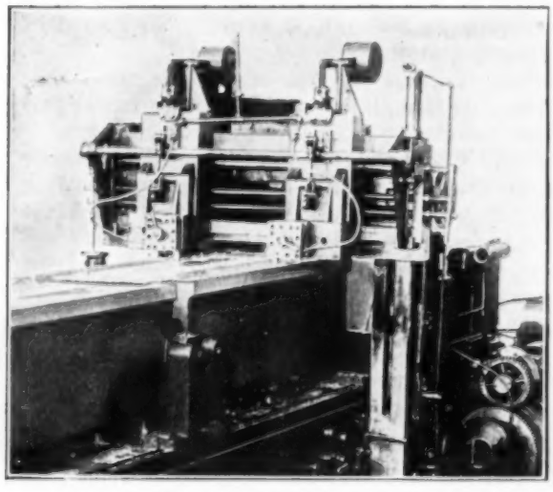
Face milling both ends of sleigh to finished length. One Otis type-3 machine was used for this purpose.

Setting and removing time, 20 min.; machining time, 1 hr. 30 min.; table feed, 30 in. per hour = 0.083 in. each revolution of spindle; peripheral speed of 24 in. cutter, 35 ft. per minute; revolutions of cutter spindle, 6 per minute. The cuts varied in depth from ¾ in. to 1⅜ in. on each end.

The cutter heads had twenty-four 1¼ in. square high-speed-steel cutters which were set in multiples of four as in Operation 1. A liberal supply of cutting compund was used.

Operations 4 and 11 were combined as a single operation at the arsenal and the time given as 8.86 hr.

In the early time studies of the recuperator it was feared that troubles might be encountered in rough boring a straight and regular hole from the solid, and in designing the type-5 boring mills, Fig. 8, these points were kept in view. This resulted in making the machines and boring bars very strong and rigid and



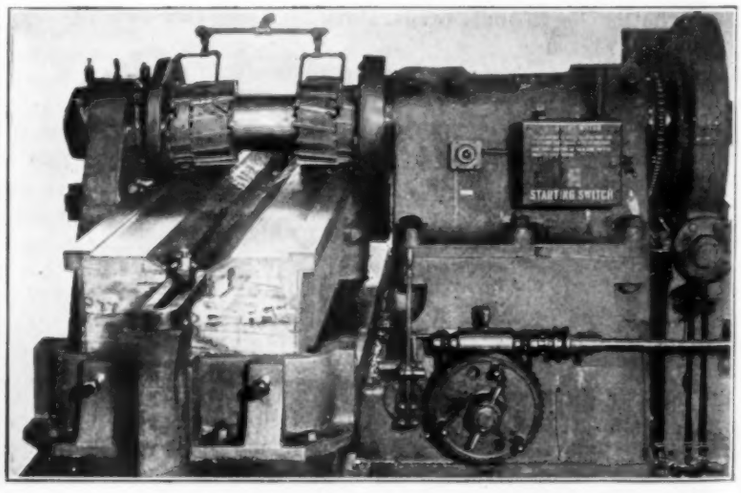


FIG. 6. PLANING TOP OF SLEIGH. FIG. 7. FINISH MILLING TOP AND EDGES OF SLEIGH

in installing a steadyrest on the machine bed into which was placed a hardened and ground bushing which fitted very closely the wearing strips of the drill head. This bushing formed the jig for starting the drill into the work and guided the drill head until the bore was sufficiently deep for the drill head to be guided by the bore.

The drill and boring heads with their cutters, as shown in Fig. 9, were found most practical after a number of tests. All heads were fitted with semi-steel wearing strips shimmed out and turned to size as often as necessary. In drilling the alloy steel forgings it was customary to refit the shims after each hole had been completed; in the carbon steel forgings usually two holes were drilled without refitting the strips.

Boring head No. 24, Fig. 9, was made in sizes 6½ in. for the recuperator cylinder and 7⅜ in. for the recoil cylinder holes. Before finish boring and reaming on type-9 triple bar machines, shown later, the 7⅜-in. drill was used for drilling the 50-in. deep holes for both reservoirs preparatory for the second cut where boring head No. 22 was used. The reservoirs were finish bored with boring head No. 25.

The 7⅜-in. drills were also used in Operations 8 and 26. The cutters were made interchangeable for their respective heads and were ground to a template. The cutting edges had several notches ground on each side of the center staggered so as to cut the chips into short rings that were forced to curl into a small diameter by the short radius lip ground in the face of the cutter. The chips were readily forced out of the bore by the strong flow of cutting compound.

Operations 5 and 6

Rough boring from the solid, two 7⅜-in. diameter recoil cylinder holes through the sleigh. Length of bore 62 in. Fourteen Otis type-5 machines were used for this purpose. Operation 6 rough boring from solid one 6½-in. diameter recuperator cylinder hole through the sleigh; Length of bore 62 in. Seven Otis type-5 machines were used for that purpose. Drilling the three holes is preparatory to finish boring and reaming in tripple bar boring mills.

Operations 5 an 6 were originally combined in one operation. The recoil holes were bored first with the sleigh set on the machine fixtures, and as the design required that the recuperator bore should be 1/16 in. below the recoil cylinder centers, it was planned to insert 1/16-in. hardened plates between the fixtures and the sleigh to establish the proper center for the recuperator bore. The tendency was for the men to forget to insert the plates and in one case the three holes were actually bored on the same horizontal center line. As that sleigh was spoiled it was decided to arrange some of the mills for boring only the two recoil cylinder holes. The sleigh was then moved to another machine where the holding fixtures were 1/16 in. higher for boring the recuperator hole.

Considerable trouble was experienced in rough boring many of the alloy steel forgings due to hard spots in the material, evidently segregation of alloys. A cutter peripheral speed of 38 ft. per minute, boring 6 in. in depth an hour, was established as about all that could be accomplished in the alloy forgings without considerable breakage of drill bits. In some instances the 3-in. steel boring-head nipple would also break when the drill entered a hard spot.

Results in boring the carbon steel forgings were much more satisfactory and the drill bits frequently bored two full depth holes without regrinding. Tests in drilling the carbon forgings were not completed at the signing of the armistice when the boring was discontinued. In a number of instances boring was done at a rate of 11 in. an hour and from the results accomplished it is believed that 12 in. depth an hour, with 40 ft. peripheral drill speed could have been maintained.

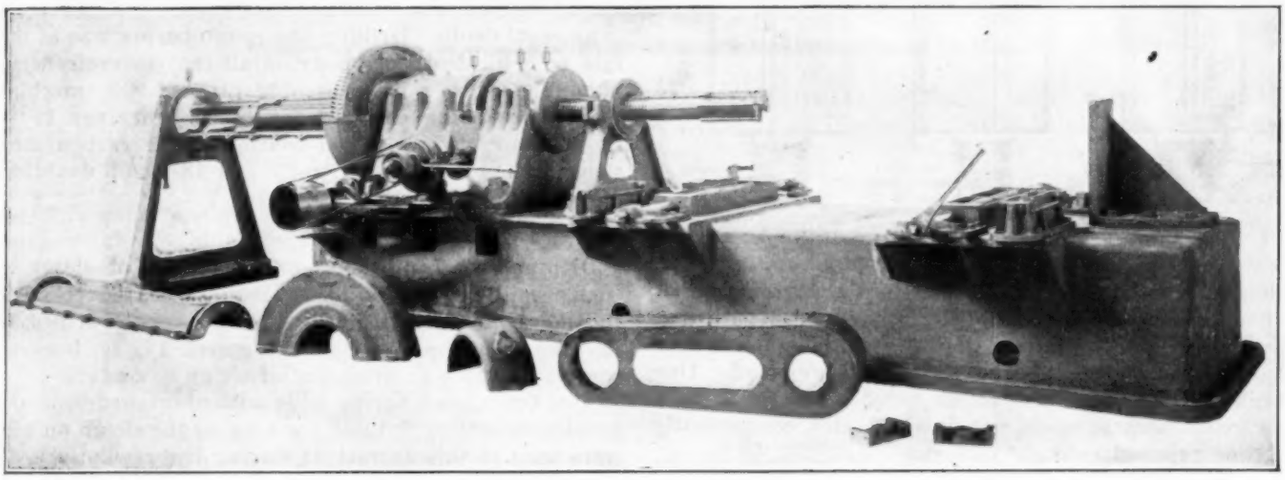


FIG. 8. A SPECIAL BORING MILL

The total time on drilling the 6½-in. and 7⅜-in. holes in 334 forgings was 15,195 hr., including the time of setting the work and the time lost due to irregularity of metal and other causes. Average time on boring three holes through alloy and carbon steel in all the sleigh forgings was 45 hr. Setting time, 40 min. each sleigh. Average time on boring one hole through ten alloy steel sleighs that were most troublesome was 19 hr. each hole. Average time on boring one hole through ten carbon steel sleighs, where the feed was 11 in. per hour, was 7 hr. The arsenal time for boring the three holes in these two operations was 21.04 hr.

A constant stream of cutting compound, at 80-lb. pressure, was maintained at the point of the drill to keep it cool and to compel the chips to flow back through the bore.

Idle time of the machines due to trouble in rough boring alloy forgings and the probability of breaking parts of the machine itself made the single bar boring mill most satisfactory for the purpose, but it is believed that the multiple bar machines are better suited for

rough boring carbon steel sleighs as they did the work equally as well as a single bar machine and, fewer machines being required, less floor space is used and some settings of the work avoided.

While boring a recuperator cylinder in one of the

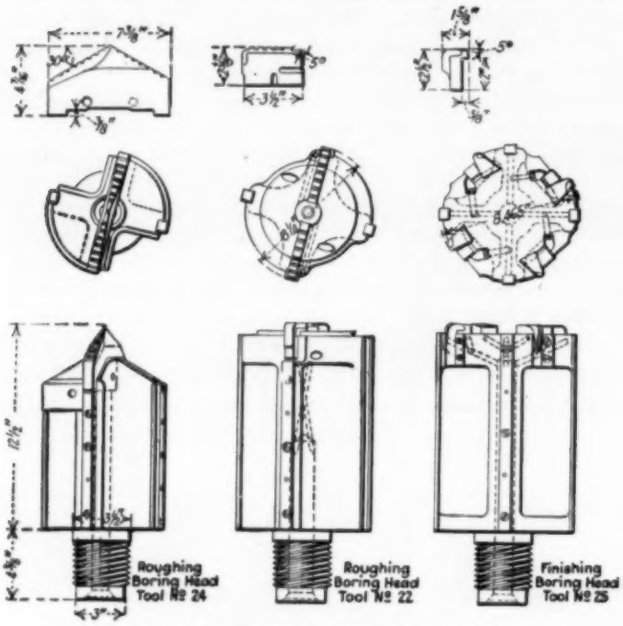


FIG. 9. DETAILS OF BORING HEAD

sleighs, the cutter evidently ran into a segregation of alloys which deflected the drill from its true path and this error was not noticed until several later operations had been completed. The sleigh was rejected. One brake cylinder was also rough bored eccentric to such an extent that it would not finish to size, consequently it was rejected.

Operation 7

Drilling two 7⅞-in. holes 50 in. deep from the solid for reservoirs and increasing the diameter to 8¼ in. by rough boring in a second cut is shown in Fig. 10. Fourteen Otis type-5 boring mills were used in this operation with 900 r.p.m. motors. Boring bar revolutions 17 per minute; peripheral speed of 7⅞-in. drill, 33 ft. per minute. Arsenal time on this operation, 18.91 hr.

Operation 13, also shown in Fig. 10, consists of finish boring the two reservoirs to 8.465 in. diameter. For this operation the sleighs were moved to another type-5 boring mill, as changing the work from one fixture to another was more expedient than to change the boring heads; particularly so as the machines were operated by one-speed alternating-current motors direct connected and the best results were accomplished in finishing with motor speed at 600 r.p.m. Seven Otis type-5 boring mills were used on this operation; boring bar revolutions, 12 per minute; peripheral cutter speed, 23 ft. per minute.

A liberal supply of cutting compound, at 80-lb. pressure, was maintained during these operations. Reservoirs in 326 sleighs has been completed when work was discontinued. Average time on drilling one 7⅞-in. reservoir hole 50 in. deep in ten alloy steel sleighs that were most troublesome was twenty-three hours. Average best time on drilling one reservoir hole 50 in. deep in ten sleighs was 9 hr. Average time on combined Operations 7 and 13, including setting the sleighs, drilling and rough- and finish-boring two reservoir holes in 326 sleighs was 71 hours.

Operations 13 and 14 were combined as a single operation at the arsenal and the time given as 4.75 hr.

The same difficulties were encountered as in rough boring cylinders in Operations 5 and 6 with additional loss of time on account of need for boring the reservoirs to an exact depth. Drilling and rough-boring was at the rate of 6 in. depth per hour on all the reservoir holes, although when work was discontinued the machine feeds were being changed for carbon forgings to 11 in. an hour. If work had continued, the carbon steel sleighs, combined Operations 7 and 13 would doubtless have averaged less than 47 hours.

Operation 8

Drilling two 7⅞-in. holes in breech end of sleigh to enable milling cutters to be readily started to their full depth in Operation 29. The holes were drilled 10 in. deep from top of sleigh and spaced 14½ in. between centers and 10⅞ in. from end of sleigh to centers.

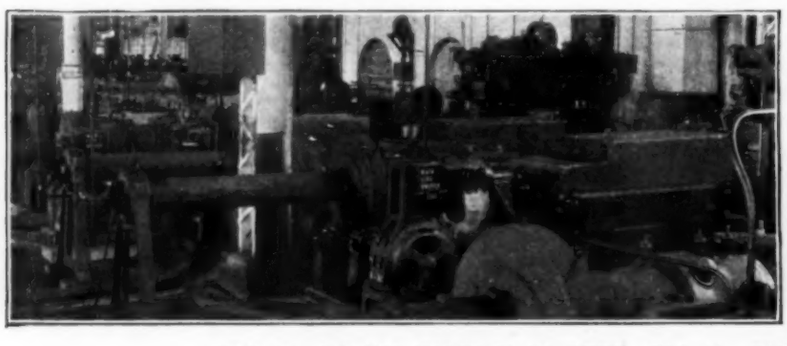
Two Otis type-5 boring mills with shortened beds and fitted with setting fixtures for holding the sleigh on end, were used in this operation: Boring bar revolutions, 17 per minute; peripheral speed of 7⅞-in. drill, 33 ft. per minute; boring bar feed, 6 in. per hour; average time on boring two holes in 280 sleighs including setting time, 3½ hr. No record of arsenal time on this operation.

Operation 9

Fig. 11 shows sawing several transverse cuts (usually four) across the back of the reservoirs, preparatory for Operation 10 where the saw, by making four longitudinal cuts removed the surplus material due to irregularity in forging.

One Otis type-3-A machine with holding fixture was used on this operation.

Worm and gear reduction 100 to 1. To secure the slow spindle speed necesary for this operation the motor was belted to the worm shaft, reducing the speed one half: Spindle revolutions, 3 per minute; peripheral speed



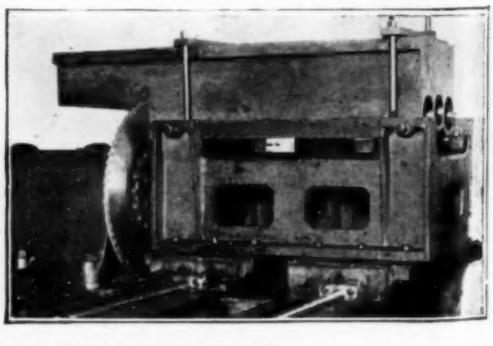
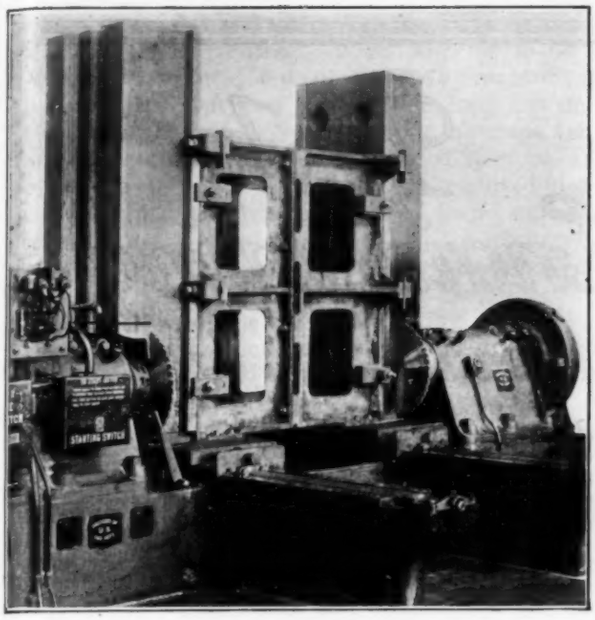


FIG. 10. BORING HOLES 50 IN. DEEP. FIG. 11. SAWING TRANSVERSE SLOTS



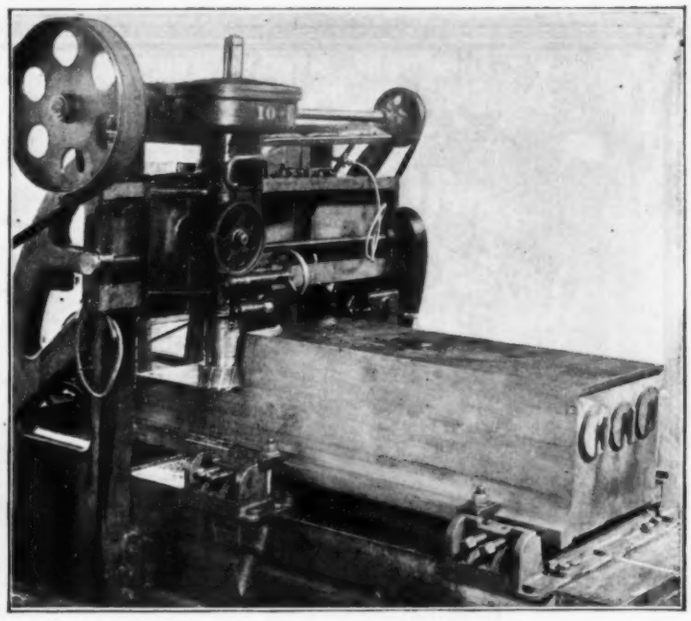


FIG. 12. ANOTHER SAWING OPERATION. FIG. 13. A SPECIAL PLANER-TYPE MILLING MACHINE

of 40 in. diameter saw, 32 ft. per minute; table feed, 27 in. per hour; average time on setting sleigh and making four saw cuts, 5 hr. No record of arsenal time on this.

Simonds saws with 66 inserted high-speed steel teeth, set alternately one round nose and one flat nose, were used on this machine. A constant flow of cutting compound was maintained.

Operation 10

Two sleighs set vertically in a duplex holding fixture sufficiently high so the end of the forging will pass over the saw arbor are shown in Fig. 12. After completing each cut across, the sleighs are lowered and the surplus material in the recesses under the reservoir is removed in slabs.

One Otis type-3 machine was used for this operation with motors direct connected to each worm shaft. Worm and gear reduction, 100 to 1; spindle revolutions, 6 per minute; peripheral speed of 26-in. diameter saws, 40 ft. per minute; table feed, 30 in. per hour; average time in setting each sleigh and making four saw cuts, 5½ hr. No record of arsenal time on this operation.

Simonds saws with fifty inserted high-speed steel teeth, set alternately one round nose and one flat nose, were used on this machine. The type-3 machine used for this purpose was originally intended for Operation 4. The efficiency of the machine on that operation, however, was much better than anticipated and with slight changes the milling machine proved to be quite a satisfactory cold saw.

The saw arbor on this machine held a number of cutting tools and it was intended to feed the 26-in. saw into the work and make a saw cut 24 in. long, the tools in the arbor in the meantime cutting a slot for arbor clearance. Tests of this method were not carried to a final conclusion due to difficulty in removing the chips. Experiments indicate, however, that the method can be satisfactorily used and all the metal removed in one cut. A constant flow of cutting compound was maintained.

Operation 11

Finish milling the stuffing box end of the three cylinders after surplus material has been removed by the saws in Operation 9 and 10, is shown in Fig. 13. Two Otis type-10 vertical-spindle milling machines were used. Worm and gear ratio, 31 to 1. Spindle revolutions, 19¾ per minute; peripheral speed of 8½-in. cutter, 43½ ft. per minute; average time setting and removing sleigh and milling one cut across face, 6 hours.

Type-10 milling machines are of the same general design as type-11 machines except for the omission of power table feed on the type-10 machines. It was the original intention to remove all the surplus material in the recess by milling and many sleighs were machined in that way before the saws used in Operations 9 and 10 were installed.

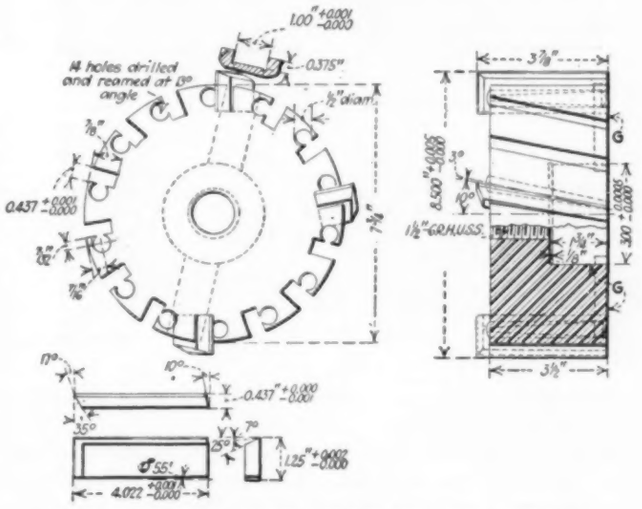
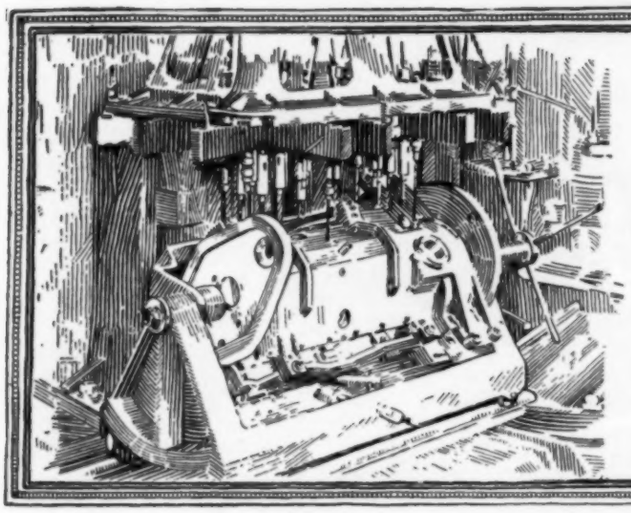


FIG. 14. DETAILS OF LARGE MILLING CUTTER

The combined average time in removing the surplus material with saws and finish milling the cylinder faces was 16½ hr. while the average time in removing the surplus material and finishing the cylinder faces by milling alone was 44½ hr. Cutter No. 30, shown in Fig. 14, was used in this operation.

Operations 4 and 11 were combined as a single operation at the arsenal and the time given as 8.86 hours.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Design of Milling Fixtures—Types of Milling Machines — Important Details in Fixture Construction—Elimination of Lost Time—Elements Necessary in Efficient Tool Designing

AS A FACTOR in high production of interchangeable parts, the milling machine is of the greatest importance. With the exception of the turret lathe and screw machine there is no other machine tool which approaches it in importance to manufacturing. On account of its value as a producer, the fixtures used in connection with it should be of the most up-to-date character and should be so designed as to obtain the greatest efficiency from the machines to which they are applied.

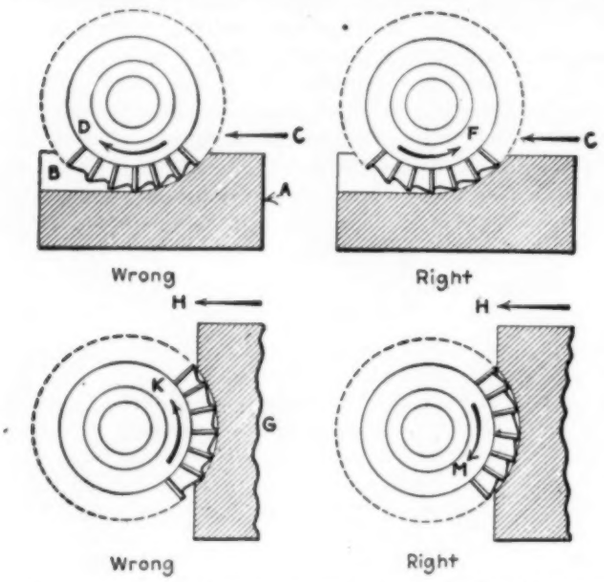


FIG. 112. DIAGRAMS ILLUSTRATING CUTTER ACTION

Types of Milling Machines

In order to understand thoroughly the requirements of milling fixtures, it is necessary first to know the various types of milling machines in order that their adaptability for different classes of work may be fully appreciated. There are a number of forms of machines, among which are hand-milling machines, Lincoln type, plain and universal, duplex, multiple spindle, vertical, continuous and some other varieties more or less specialized either in general mode of operation or in their application to particular kinds of work. Among the latter class are spline milling, profiling, cam cutting, automatic form-milling, rack cutting, gear cutting and hobbing machines. There is also the thread milling machine for milling screw threads and worms. In fact, the process of milling is adapted to so many kinds of work that new machines, which employ milling as a means for removing stock, are continually being developed to assist in the solution of production problems.

Considered as a machine type, there are more varieties of milling machines on the market than any other machine tool in use today. The engine lathe is frequently used in small shops as a milling machine and many horizontal boring mills are arranged so that they can be used for milling as well as for boring. In reality, any machine having a spindle to which a milling cutter can be applied has possibilities in the line of milling, and can be adapted to this kind of work by the use of a sliding fixture arranged to operate at right angles to the spindle.

However, we shall take up the application of milling fixtures to only those types of milling machines that are commonly used for production.

Important Points in Design of Milling Fixtures

In the design and construction of milling fixtures, the following points should be carefully considered:

1. Production required. This is an important factor as the number of pieces to be machined should influence the design of the fixture to a great extent. Simple fixtures should be made for work which is machined only in small quantities, while for high production work the best type of fixture should be designed.

2. Dead time on the machine. In analysing a production problem in which the milling machine is to be used, the dead time on the milling machine should be reduced to a minimum in order to obtain the maximum efficiency of the machine. The milling fixtures should be so designed that there is as little time lost as possible during the loading and unloading of the fixture. In very high production work it is frequently desirable to make up fixtures that permit one piece of work to be

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inserted and clamped while the other is being machined.

3. Accuracy required. When work is to be milled within a tolerance of 0.001 in., it is frequently necessary to make provision for both roughing and finishing cuts. As a rule two fixtures should be made for work of this kind, each one being provided with suitable set blocks for setting the cutters to the required sizes.

4. Rigidity of fixtures. There is no operation in manufacturing in which *rigidity* is as important as in milling. Weakness tends to develop "chatter," which is injurious both to the cutters and to the machine. Care must be taken in the design of milling fixtures to make sure that there are no weak points and that all portions are well ribbed to withstand cutting strains.

5. Safety of the operator. The importance of designing milling fixtures so that the operator will not be endangered during the process of loading and unloading the work cannot be over emphasized. The operator's hands should not approach the cutters closely. The position which the operator is required to take when using the fixture must be studied so that there is no chance for injury due to lack of attention.

6. Chips. As the milling machine is a great producer of chips, attention should be paid to the cleaning of the fixture, and clamps, locating surfaces, and

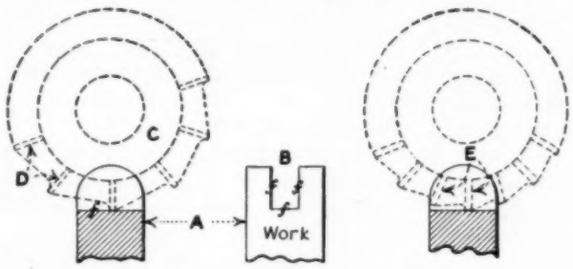


FIG. 113. ACTION OF CUTTER TEETH

other important parts should be so designed that chips will not interfere with their proper functioning.

7. Set blocks. All milling fixtures should be provided with set blocks so arranged that the cutters can be set in correct relation to the work. A size block or "feeler" can be interposed between the cutter and the set block when making adjustments. If all fixtures for milling are provided with set blocks the accuracy of the work is assurred, and resetting after grinding the cutters is very easily done.

8. Selection of machines. The selection of the machine best suited to work requires judgment, knowledge of conditions, and a list of machines which may be used, as well as an understanding of the best type of machine for the work in the event that new tools are to be purchased. Although the choice of machines may be limited, the selection should always be made with a view to economy in production.

9. Upkeep of fixtures. Fixtures for high production work should be so designed that replacement of locating parts, studs, clamps and other parts can be readily made. It is very necessary to provide a suitable method of fastening the various units to the fixture in order to facilitate their removal and replacement when worn.

10. Material to be cut. The kind of material to be machined affects the design of the fixture to some extent, due to the fact that cast-iron or other cast work such as aluminum and brass can usually be cut faster than such material as alloy steel. Therefore, the kind of material and the speed and feed at which the job will run have to be considered in planning milling fixtures.

A piece of work being milled is subject to two forces, viz., the feed and the cutting action. The combined

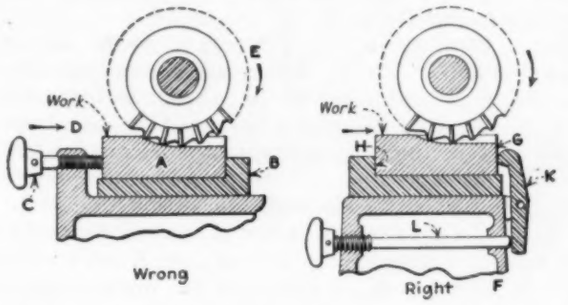


FIG. 114. CUTTER ACTION IN RELATION TO CLAMPS

result of these two forces tends to move the work out of its position, hence it must be resisted by the fixture and the clamps which hold the work. Due consideration must therefore be given to the manner in which the work is held in relation to the feed and also to the cutter.

Fig. 112 shows a piece of work at *A* in which a slot *B* is being machined. The feed of the table is in the direction of the arrow *C*, while the cutter revolves as shown by the arrow *D*. The action of the cutter tends to pull the work toward it, which is very bad practice for the reason that any lost motion in the feed screw of the table will cause "chatter" in the work; also the work tends to "crowd" into the cutter teeth so that the cutting action is not good. When the work is fed in the same direction *C* with the cutter revolving in the direction *F*, there is no "chatter" and the teeth of the cutter attack the work in the proper manner.

The work *G* is being fed in the direction of the arrow *H*, while the cutter is revolving as at *K*. This is incorrect because the cutter action tends to lift the work

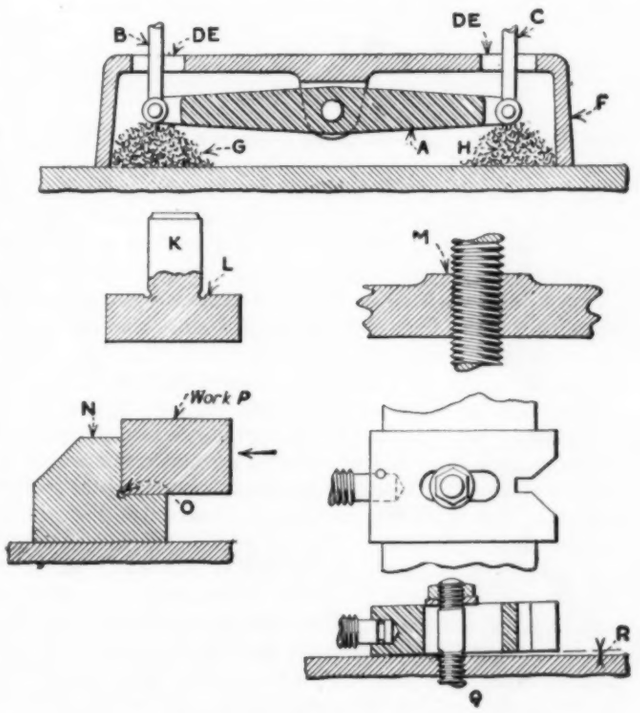


FIG. 115. TROUBLE CAUSED BY CHIPS

and may therefore be acting against the clamps which hold it down on the fixture. It may even lift the table itself unless the gibs are adjusted tightly.

When the cutter is revolving in the direction *M*, the pressure of the cut is resisted by the stability of both the fixture and the table.

Fig. 113 shows a lug *A* which is to be slotted as indicated at *B*. Unless care is used in the selection of the cutter, a condition like that shown in the cutter *C* may be found. This cutter has teeth *D* spaced so far apart that not more than one tooth is in action on the work at the same time. If the feed is coarse, considerable "chatter" and poor work may result.

It is much better to select a cutter having teeth spaced closer together as indicated at *E*, so that there will be several teeth in action on the work at the same time.

In designing milling fixtures it is not generally considered good practice to clamp the work in such a way that the cutting action is against the clamp. Fig. 114 shows the work *A* held in a fixture *B*, by means of a clamp screw *C*. The direction of the feed *D* and the rotation of the cutter *E* both force the work against the clamp screw. This is very bad indeed and should be avoided.

At *F* the work *G* is firmly clamped against a solid shoulder of the fixture *H* by means of a rocking clamp *K* operated through the threaded rod *L*. The thrust of the cut is then taken by a solid wall of metal and there is no possibility of "chatter."

Milling cutters produce chips very rapidly and in large quantities. Therefore milling fixtures should be designed so that locating surfaces, clamps, screws and other devices will not become clogged with chips so as to interfere with their proper working. Fig. 115 shows an equalizing lever *A*, connected to two rods *B* and *C* which pass through the holes *D* and *E* in the body of the milling fixture *F*. The openings around the rods permit chips to fall through and accumulate at *G* and *H*, resulting eventually in interference with the action of the levers. The holes should be covered in order to prevent this accumulation or else the fixture should be arranged so that it can be readily cleaned. As a milling fixture is always bolted down to the table in a fixed position, provision for cleaning should not necessitate its removal from the table. Openings in the side of the fixture can be made but it is better to prevent the chips from entering and thus do away with the necessity for cleaning.

At *K* is shown a locating stud with a groove at *I* into which chips or dirt may drop so that work located on the plug will seat itself properly. This is very bad indeed as after a time the groove fills up with chips and dirt which have to be cleaned out frequently to allow the work to locate properly. *M* is an adjustable, threaded member in a fixture base. This also should be avoided as far as possible because chips will eventually work into the thread and make it difficult to operate.

The locating block *N* is relieved at *O* in order to ensure correct location of the work *P*. This design is open to the same objections as the example *K*.

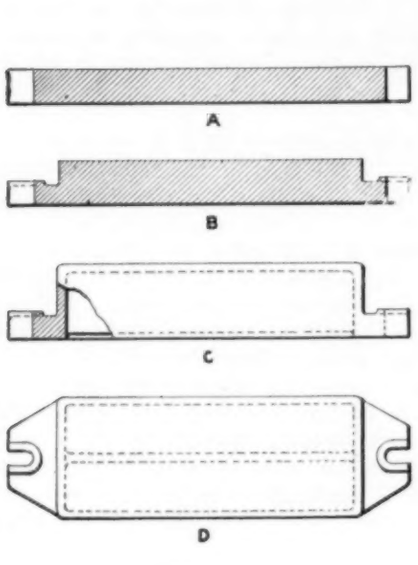


Fig. 116

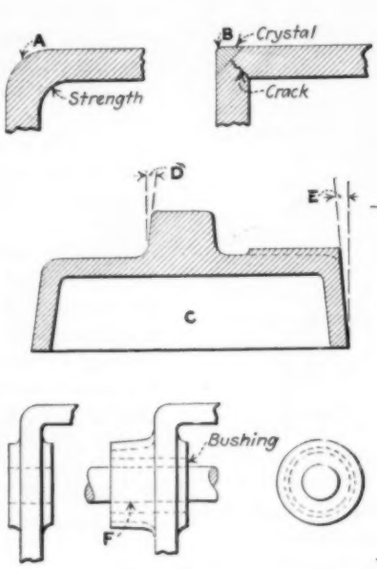


Fig. 117

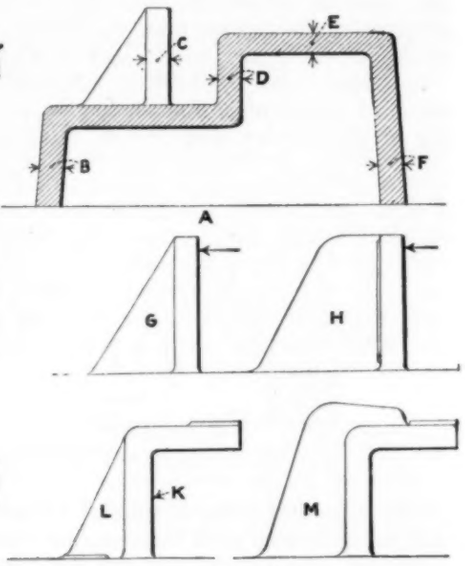


Fig. 118

FIG. 116. DESIGN OF FIXTURE BASES FIG. 117. DETAILS OF CONSTRUCTION
FIG. 118. UNIFORMITY OF RIBS AND WALLS

The type of adjustable V-block shown at *Q* is most annoying to an operator, as the chips get in to the elongated slot and also under the block causing it to rise as shown at *R*.

There is some difference of opinion as to whether a well-ribbed milling fixture will give as satisfactory results as one which is made of very heavy section cast iron without ribbing. Those advocating heavy sections without ribbing claim that the solidity of the metal in a heavy milling fixture tends to lessen vibration and thus give better results than a ribbed milling fixture. The writers believe that a well-ribbed milling fixture of substantial section will answer the purpose in nearly all cases although for extremely heavy cuts a good body of metal is desirable.

Fig. 116 shows at *A* a solid base plate of cast-iron on which a built up fixture can be placed. The illustration *B* shows a similar, though heavier plate. The latter would be better designed as shown at *C*, with the mass of metal reduced and the sections strengthened by the use of ribbing. The view at *D* indicates the position of the various ribs. The ribs of a fixture of this type should be so proportioned that there wil be no tendency

to "buckle" and thus cause vibration while a cut is in progress.

Fig. 117 shows a corner wall *A* which has been made to a large radius in order to give maximum strength.

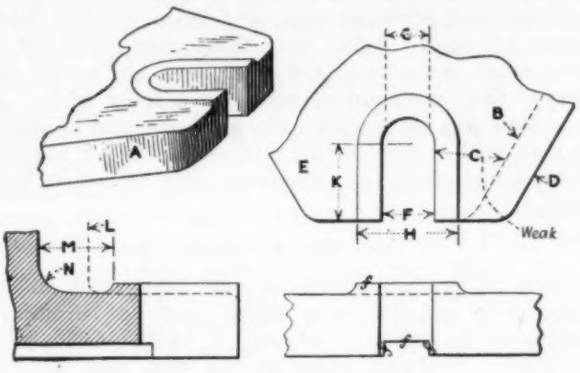


FIG. 119. U-LUG DESIGN

Square corners on castings and sections of unequal thickness should be avoided. *B* shows a square corner which is likely to crack at the points shown, due to strains set up by unequal cooling in the foundry.

The diagram at *C* is given in order to emphasize the fact that all castings should be so designed as to allow for "draft." Draft is not necessary to the casting, but the pattern has to be tapered so that after the mold is made, the pattern can be removed from the sand without injuring the mold. And as the pattern is a duplicate of the casting, the necessary draft is included in the design of the casting. The amount of draft necessary varies from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. per foot. It is advisable to show the draft on deep castings as indicated at *D* and *E*.

Where bosses are provided on castings it is well to make them larger in diameter than appears necessary, in order that the location of holes in the bosses may not be seriously affected by variations in the casting. Also when bosses are used as bearings, it is advisable to make them large enough so that they may be bushed for wear as indicated at *F*. There is nothing much more annoying to a toolmaker than to find insufficient allowance for stock on a boss, so that the hole is not central with the boss, allowing a shouldered stud to lap over the edge.

In order that the castings used for fixture work may be substantial and not subject to cracks due to unequal

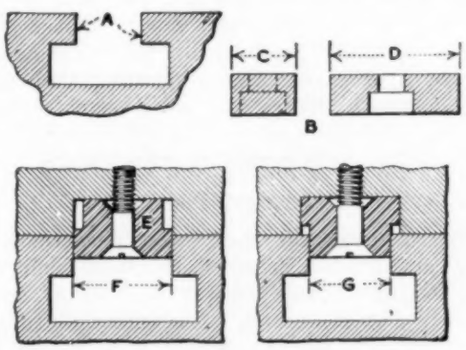


FIG. 120. T-SLOTS AND KEYS

cooling, uniformity in the sections should be preserved as far as possible. Fig. 118 shows a section *A* in which the walls *B*, *C*, *D*, *E* and *F* are all of uniform thickness. A fixture designed in this manner will be free from defects or cracks in the metal which are often caused by unequal cooling.

The correct design of ribs is an item which should be given the most careful attention. It is not uncommon to see an angular rib like that shown at *G* when there is no good reason for making it so light. A rib like that shown at *H* will withstand pressure very much better than the other one.

In the case shown at *K*, the rib *L* has very little value; yet if it were to be made as at *M* it would give stability to the construction and add to the general rigidity of the fixture.

A milling fixture must be bolted to the table on which it is used, therefore a means of fastening must be provided so that it can be quickly adjusted when removing or replacing it. In Fig. 119, *A* shows a good construction for U-lugs. Lugs made to the outline shown by the dotted line at *B* develop a very weak section at *C*. By designing the lugs as indicated by the full lines at *D* and *E*, greater strength is obtained and there is less likelihood of breakage. U-lugs are usually cored at *F* and the cored dimensions should be not less than $\frac{1}{8}$

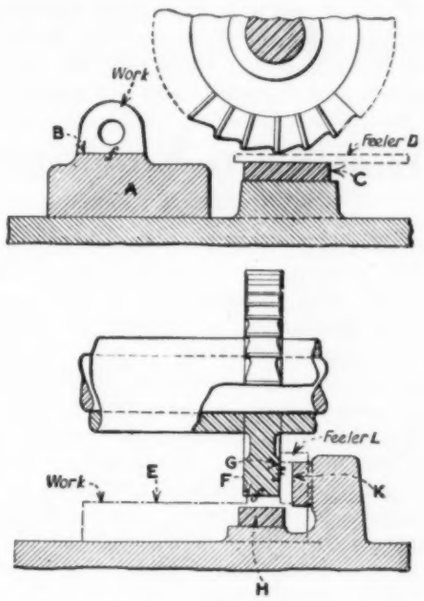


FIG. 121. SET BLOCKS

larger than the T-bolt used to hold the fixture down. A key slot *G* is provided for locating the fixture on the table.

In proportioning the outlines of the boss *H*, it is well to make each side of the finished portion at least one-half the distance *F* and even more than this is not objectionable. The depth *K* should always be from one and one-half to two times the dimension *F*.

U-lugs should not be set in too close to the body of the fixture as indicated by the dotted lines at *L*. It is much better construction to make the distance *M* at least as much as the dimension *F*. When this is done a large fillet can be used at *N* thus giving additional strength to the fixture.

Milling fixtures are located on the tables of milling machines by means of rectangular keys which fit the T-slot *A* in Fig. 120. A common form of key is shown at *B*. The dimension *C* is made to the size of the slot in the milling machine table. The length of the key *D* is generally from 2 to 3 times its width.

As milling machine table slots vary from $\frac{1}{2}$ in. to $\frac{3}{4}$ in.

with intermediate sizes, it is often desirable to make fixtures transferable from one machine to another. To provide for such a condition, the keys can be made as shown in the illustration at *E*. This type of key is so proportioned that it can be used to fit a slot having a width as shown at *F* and it can also be reversed and used to fit another slot like that indicated at *G*. An arrangement of this kind is of great advantage where a number of milling machines having different size slots are to be used in production.

In order to make sure that cutters are set in the correct relation to the work on a milling fixture, it is essential that each fixture be provided with suitable set blocks.

Assuming that the work *A* shown in Fig. 121 is to be machined at *B*, a hardened set block *C* should be provided. In setting the cutter to the correct depth a "feeler" *D* is interposed between the cutter and the set block *C*. The thickness of "feeler" can be standardized and suitable allowance made between the top of the set block *C* and the depth of the cut desired.

In the example *E* the work is to be finished on the surfaces *F* and *G* and it is, therefore, necessary to provide set blocks at *H* and *K* so that the feeler *L* can be interposed as indicated in order that the cutter may be accurately set, both vertically and horizontally.

Foreman or Teacher—Which?

By William A. Ayars

For some sixteen years it was my enjoyable and congenial duty to earn my living as a technical teacher. But I did not, like the majority of such teachers, go directly from graduation in mechanical engineering to teaching. Nor, after starting to teach, did I desert all other branches of engineering to stick closely to the educational side. Most colleges grant from three to four months of summer vacation, and no live man wants to waste that much time, intellectually, physically or financially. I found it highly profitable on all these grounds to get a job of some sort during these vacations, and whenever such jobs were available I took one. They kept me from going stale, they provided me with abundant material to use in my next year's teaching, and they more than paid expenses. But I think the most valuable thing I got out of those summer jobs was the associations I had, not alone with skilled workers, but with executives, minor and major. As more or less of a "free lance," I was given far more of a look behind the scenes in many cases than I should have had as a permanent employee, and frequently had an opportunity to discuss the same problems with men in vastly different departments.

One interesting case came up in a locomotive works. At lunch one day the general foreman told me he was much upset by an order from the general manager that he reduce his force by a certain number, and that with the order had come a list of the men's names who were to be laid off; and that they were the best men he had. The same evening I sat on the porch with the general manager, and he told me the same story, saying that he knew Jim was rather upset; and then explained why he had issued the order. Future contracts were not very plentiful, and it was necessary to cut down. In anticipation of some such contingency he had some time before had the employment department give him a pretty complete history of each man in the shops, including their ages, whether married or single, and how many dependents or children each had. When the time came to cut down the force, he had himself selected all the younger and stronger men, and those without dependents; his reason being that these men could get new jobs much easier than the older ones, and would suffer less if they were out of work for a short while. This manager was an exceptionally good one, and he was also a man with a very kindly disposition and a big heart. I have had plenty of experience with the other sort as well.

Bossing, or Teaching?

One of the new "slogans" we hear much about is frequently printed on a heavy card and prominently displayed in executive offices. It is "TEACH, DON'T BOSS!" Probably some of the men who display it really mean it, but I know many who don't. A very successful works manager once told me that he owed a debt he never could repay to the shop where he had served his time. This was a small country shop, and the foreman was also owner, superintendent and manager. Every boy in the shop was a personal responsibility to him, and he saw that they learned all he could teach them, even when that teaching meant delay or loss on some of the jobs. I said to him, "Bill, if that old owner-foreman came to you today and wanted a job as a foreman, would you give him one?" "Not as a foreman," said he, "but if I were running a trade school, or had a regular department for training apprentices, I'd hire him on the spot!" This seems to show that teaching and foremanship do not always harmonize.

The Training Department

Again, during the late war, I was employed for some time in the education and training division of the Emergency Fleet Corporation. The work of this division was to supervise and assist in the intensive training of the unskilled men employed by the shipyards. There was always trouble with some of the yards in trying to make the management see that the green men taken on in the training department were first to be taught, and that during their training period it was rarely advisable to try to make them productive. In other words, the training department was not to be gaged by the amount of productive labor done by the learners, but by the number and the skill of the men turned over to the shops and ways. Where this principle was cordially accepted by the management, the results were excellent; where it was either openly or secretly opposed, the results were poor. I remember almost the same problem coming up repeatedly in technical education, with regard to school shops.

University Products

Successful practical men, who nevertheless knew nothing about educational work, were and are continually asking the colleges why they do not make their shops turn out something of commercial value—some tangible product that can be sold at a profit. Now the usual college that has well equipped shops feels that it *does* turn out a valuable product, but the product thought of is not a machine or a piece of furniture. It is a boy who has learned something valuable to him and to his future employer. I am referring, of course, to shops

foming part of the mechanical equipment of a college or a university, not of a trade school. In a trade school it is quite feasible to secure a fair profit by manufacturing some article or articles that are salable. Or if this be not expedient, work can be secured that at least cuts down on the running cost of the school. One such instance occurred in the re-education shops run by the Department of Soldiers' Civil Re-habilitation in Canada. One of the courses taught was machine tool operation, and as the school had no foundry, the cost of small rough castings to be machined was a considerable item. A further disadvantage, as all who have taught manual work well know, lay in the fact that small rough castings which, when machined, have no further use or value, have very little interest to the embyro craftsman. So an arrangement was made with a large manufacturer of pumps to send to the school unfinished parts of small duplex pumps, and these were machined by the students under close supervision by the instructors (all of whom were highly skilled mechanics) and then shipped back to the factory. Thus the school saved a great deal of needless expense and the manufacturer got a certain amount of labor at no greater cost than the freight on the castings between the factory and the school. As these two establishments were a great many miles apart, the manufacturer did not get off so cheaply as might be imagined, but it was a very satisfactory arrangement just the same.

Producing in the School Shop

There are school and college shops today where a commercial product is made and sold, but I have been told by those who know, that it required practically a double organization to keep them running: a number of paid skilled workmen with a foreman to attend to the purely factory side of the shops, and the instructors to look after the teaching side. From an instructional point of view, any one who has had experience knows that a spoiled piece of work frequently teaches the man who did it more than if he had done it correctly. But if that piece happened to be one of a lot needed to complete an order, and the whole order is thereby held up until a new one can be made, the man who is responsible for the commercial output of the shop is by no means pleased, no matter how much the bungler may have learned by the mishap.

Difference in Methods of Teaching

Some "practical" man may ask why there should be any difference between the methods of teaching a student in an engineering school or university, and in a trade school. This is still debatable, I admit, but I think most men who speak with authority in matters of technical and engineering education are fairly well agreed. To me the difference appears very simple: the object of the trade or industrial school is to teach a trade; and of the college or university, a profession. It is highly desirable that a mechanical engineer should have had a good shop training, not so much to make him a skilled mechanic, but to give him a thorough knowledge of shop processes and of planning his work so that it can be done with a minimum of cost of both labor and material. The trade school, on the other hand, aims to train its students so that they may be accurate, rapid and efficient workers at their chosen trades.

A shop foreman should have teaching ability as well as executive, but he cannot afford to devote much time to teaching anything but the "high spots" during his working day. If a new machine comes into the shop, he should himself learn that machine thoroughly and when he assigns a man to that machine, he should be able to instruct him, not in the essentials of the trade, but in the operation of that machine. It is quite probable that in a short time the man operating the machine will know far more about it than the foreman or even the designer. I have had the chief engineer of a great machine-tool factory tell me that many customers know far more about the machines than the builders themselves and that frequently when buyers write in to the factory for information as to how the machine is to be used or adjusted, they answer by referring the questioner to another customer who is using the machine on a similar process, and who can give the help asked for better than the builder. Designing and building ability is quite different from operating ability. It is only necessary to watch a competent typist at work to prove this, or to note the annoyed helplessness of the professional organist when something happens to his intricate instrument.

Responsibility for Training

It seems that the old apprenticeship system has gone, never to return. Still, industry must carry on, and it must train its thousands of recruits every year. How will they get the training? When times are good and shops are busy, there is lively competition for good men, but the novice has a hard row to hoe. As soon as he confesses to his lack of training he is told he is not wanted. Every employer is willing to pass the buck and "let George do it," and some are none too scrupulous in taking George's men away from him just about the time they are getting useful. What is the remedy? It seems to me that there are two ways of solving this problem. One is by means of trade schools which should be liberally helped and supported by all factories in the vicinity which expect to draw on them for future employees, and the other is by means of well-equipped apprentice-training departments in large organizations. And in the latter case, let those in charge be duly and even forcibly impressed with the fact that they are supposed to turn out skilled men and not commercial products. It will usually be found that a great deal of commercial product can be turned out of an apprentice-training department, but if so, let this product be accounted "velvet," and the department judged and weighed solely by the number and quality of its graduates. This is of course nothing novel; many such training departments are in successful operation today and a few of the smaller plants still have regular apprenticeships, where the boy who starts in has no obstacles thrown in his way, even if he does not get a great deal of real assistance. Let the foremen in productive work teach, if necessary, the *how* of doing the various jobs and the *why* of certain things that may appear inexplicable to intelligent and reasoning men. But he should neither be allowed nor encouraged to teach the *trade;* that should be taken care of in either of the two methods indicated above. And in choosing men to teach the trades, see to it that they are born teachers, and do not compel them to make too much of a financial sacrifice in order that they may do the work they love to do, and can do far better than one who does it for a living only.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Emergency Repair on a Crusher Shaft

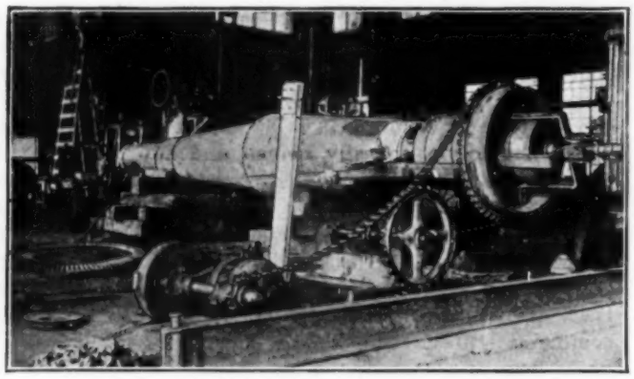
By H. Beard

The part shown in the accompanying illustration is the vertical spindle of a No. 24 Gates crusher. It weighs 37 tons and is about 25 ft. long.

The nut that holds the core on worked off, and the thread on the spindle was so badly damaged as to make rethreading necessary. There was no lathe within 500 miles large enough to handle such a job and it was therefore up to us to devise a means of cutting a new 14-pitch thread, 24 in. in diameter with the means at hand.

The spindle was blocked up and the top bearing babbitted and bored to fit the shaft. The rim of an old sprocket was fitted to the flange of the bearing and a 5 x 5-in. billet of steel bolted to it in such a way as to extend parallel to the axis of the spindle. The lead screw of an old lathe was fitted in the eyebolt hole and a nut on this screw connected by forged straps to the bearing to feed the latter along.

The cross-slide of the lathe was bolted to the billet to manipulate the tool and power for driving the device



EMERGENCY REPAIR ON A CRUSHER SHAFT

was furnished by a reversing motor, driving through chains and countershaft.

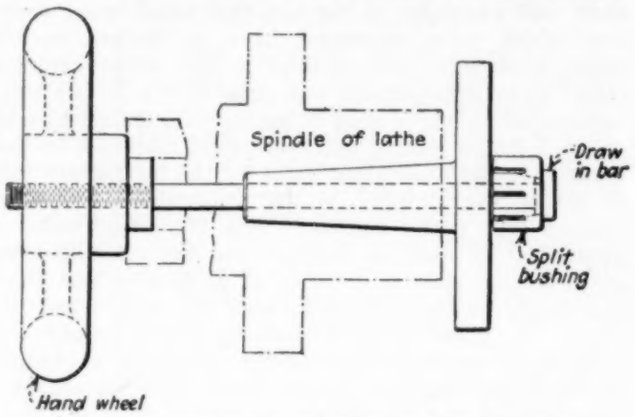
It took a machinist and helper about eight hours to turn off the old thread and cut a new one. The operation was very smooth and without chatter. The setting up naturally required more time, but the freight on the piece to the nearest lathe would have been more than our entire cost.

Expanding Arbor to Hold Small Gear Blanks for Facing

By Lester Ferenci

On page 693, Vol. 54, of *American Machinist* Milton Wright suggests a method of chucking gear blanks for the finish facing operation on an expansion stud arbor. An idea that I have found better suited for this kind of work is shown in the accompanying illustration. I believe there is a decided advantage in this construction.

In this class of work the important factor is to make the two faces of the work parallel with each other. Using the construction shown herewith, as the split



EXPANDING ARBOR TO HOLD SMALL BLANKS FOR FACING

bushing is drawn in over the taper of the body it grips the bore of the blank and at the same time forces the face of the work, by its own movement, against the face of the arbor; thereby squaring it up. If the face of the arbor runs true, the faces of the work will be parallel.

Another advantage is that by using a split bushing the bore will be gripped on its entire length, even in the case of a large bore, where as by Mr. Wright's construction the arbor will grip only on the outer end when the bore is oversize.

Converting a Planer from Screw to Worm Drive

By R. T. Wilson

In our machine shop we had a large English screw planer which it was found necessary to convert to a worm drive. This work required the boring of a 3¼-in. hole at an angle of 12 deg. 30 min., the angle of the worm and rack, for a distance of 24 in. through the solid bedplate casting and a number of heavy ribs. We had no boring mill in the shop, and to do the work we set up an old engine lathe bed on the floor at the right height for the bore and at the required angle, with the planer ways. Parallel to the lathe bed we fixed up a jackshaft with two pulleys driven from a 3-hp. motor.

Our first operation was to drill a 1¼-in. hole the full length of the cut to be made. This we did by setting an electric drill with a twist drill having a shank three feet long in the tailstock center with the shank guided through the lathe steadyrest. The tailstock spindle advanced the drilling machine until the first cut was finished.

We replaced the drilling arrangement with a 4-ft. bor-

ing bar 2 7/16 in. in diameter, turned on the cutting end to 1¼ in. diameter for a length of 2 in. to form a pilot. A hole ½ in. square was made in the boring bar, close to the shoulder of the pilot, to take the toolbit.

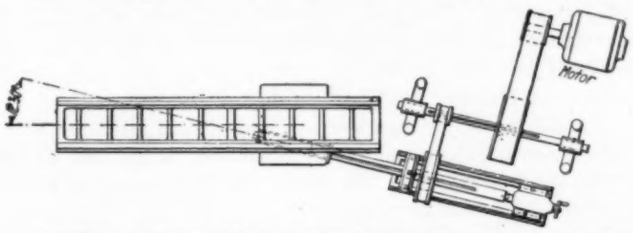
The first bit used was ground with two cutting edges, one a little ahead of the other and set for a 4¼ in. diameter cut. With this bit held in place by a setscrew the hole was spot-faced. We then exchanged the toolbit for a similar one 3¼ in. wide, the final diameter required for the hole.

After the first 14 in. of the cut was made a guide bushing, flanged at one end to fit into the 4¼-in. spotfacing at the beginning of the cut, was placed in the cut. This guide bushing together with the steadyrest furnished a means of holding the boring bar in an absolutely true position.

As the boring bar advanced in the cut, the spline in the bar and in the jackshaft permitted the necessary adjustment of the pulleys.

The entire cut of 24 in. was made without removing the planer from its position on the floor. Only such material as we had available in the shop was used to do the work. With only one mechanic we finished the job in two working days. The illustration shows the manner of the set up.

The boring was the most difficult part of the job,



BORING LARGE HOLE IN PLANER BED AT AN ANGLE

as we had to improvise the rig for doing it. As there was nothing unusual in making either the rack or the worm no further description is necessary.

Division of Prime Numbers

BY A. E. TWIGG

I should like to make formal acknowledgment for the many useful kinks, learned from the *American Machinist*, that I have profited by during the last twenty years. I am sending a description of a method for originating an index plate to be used in cutting gears. I saw this method worked by an old friend and foreman instructor some years ago, and he told me that he

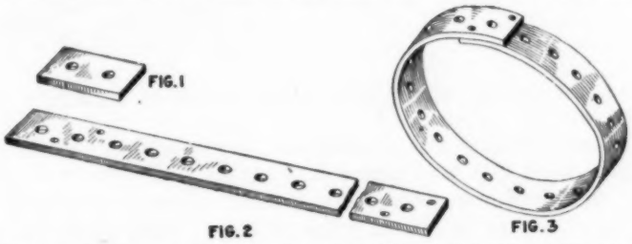


FIG. 1. THE JIG. FIG. 2. BAND IRON DRILLED WITH JIG SHOWN IN FIG. 1. FIG. 3. BAND IRON BENT IN A CIRCLE

learned it from his grandfather, an old working machinst. That was in the days when dividing heads "were not."

Take a piece of hoop iron sufficiently long, also a short piece of sheet iron or steel of any suitable gage and length for use as a jig. In the latter drill two holes about ⅛ or 1/16 in. in diameter any distance between centers as in Fig. 1. Fix a short piece of drill rod in one of the holes and use it as a step jig to drill aforesaid strip of hoop iron, drilling the number of holes required for the index plus one or two extra for overlap, as in Fig. 2. Bend the hoop iron into a circle bringing the overlapped holes fair and fasten the ends with rivets, as in Fig. 3. Turn a disk of cast iron or hard wood to fit inside the diameter of the hoop and force the hoop on it. The disk is driven on the dividing spindle and the arrangement is complete.

Volume Removed from a Sphere by Boring

BY FRANCIS M. WESTON, JR.

A machinist once asked me how large a hole should be bored through a 4-in. cast-iron ball to remove one quarter of its weight? After working out the proper diameter of hole for the particular case in question it seemed that a general formula covering all possible cases might prove useful. From the accompanying diagram it will be seen that a hole bored through a sphere removes material as follows: (A cylindrical central portion, *ABCD;* and two equal spherical segments *AEB* and *CFD.*)

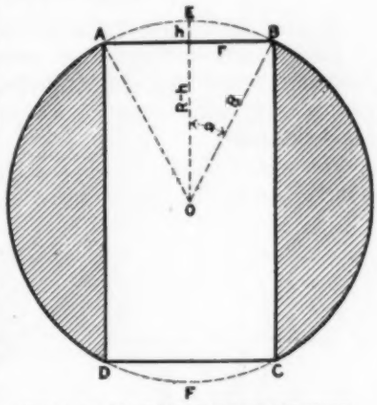


DIAGRAM FOR DETERMINING VOLUME REMOVED FROM A SPHERE BY BORING

Let $D = 2R =$ diameter of sphere.

$d = 2r =$ diameter of hole $= AB$.

$h =$ height of sperical segments *AEB* and *CFD*.

$D - 2h = 2(R - h) =$ length of cylindrical part of hole.

$a =$ half of central angle subtended by chord $AB = EOB$.

$m =$ percentage of volume of sphere to be removed.

Then: Volume of sphere $= \frac{4}{3}\pi R^3$.

Volume of cylinder $= \pi r^2 \times 2(R - h) = 2\pi r^2(R - h)$.

Volume of spherical segment $= \pi h^2\left(R - \frac{h}{3}\right)$.

From the diagram it will be seen that

$$r = R \sin a \qquad (1)$$

$$h = R(1 - \cos a) \qquad (2)$$

The volume of material to be removed by boring is expressed by the equation

$$2\pi h^2\left(R - \frac{h}{3}\right) + 2\pi r^2(R - h) = \tfrac{4}{3}\pi R^3 m \qquad (3)$$

Substituting in equation (3) the values of r and h as given in (1) and (2),

$$2\pi R^2(1 - \cos a)^2\left[R - \frac{R(1 - \cos a)}{3}\right] + 2\pi R^2 \sin^2 a\,[R - R(1 - \cos a)] = \tfrac{4}{3}\pi R^3 m.$$

Dividing both members of this equation by $2\pi R^3$ and clearing of fractions, we have

$$(1 - \cos a)^2 (2 + \cos a) + 3 \sin^2 a \cos a = 2m$$

Performing the indicated multiplication and collecting terms (remembering that $1 - \sin^2 a = \cos^2 a$), we obtain

$$\cos^3 a = 1 - m$$

$$\cos a = \sqrt[3]{1 - m}$$

$$a = \cos^{-1} \sqrt[3]{1 - m} \qquad (4)$$

Substituting this value for a in equation (1),

$$r = R \sin (\cos^{-1} \sqrt[3]{1 - m})$$

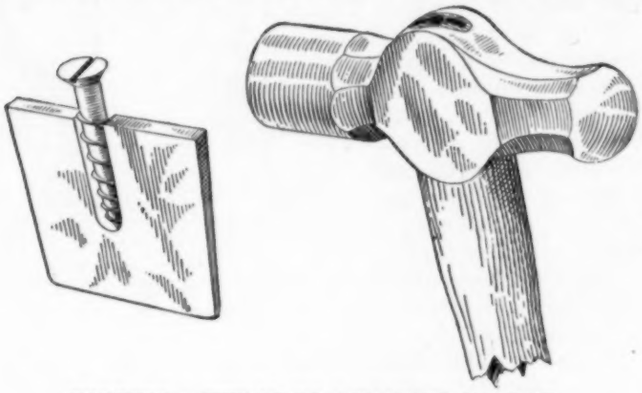
$$\text{or } d = D \sin (\cos^{-1} \sqrt[3]{1 - m}).$$

An Efficient Wedge for a Hammer Handle

By R. McHenry

At last I have hit upon a simple form of wedge for a machinist's hammer that seems to hold. The continued jar and the slight shrinkage of the wood soon causes the usual type of wedge to work out and the head to loosen.

The wedge shown in the sketch is of steel and extends nearly across the eye lengthwise. I first drilled a hole



HOLDING A WEDGE IN A HAMMER HANDLE

through the center of the wedge slightly larger in diameter than the thickness of the wedge at the top. Two parallel saw cuts down to the outside edges of this hole were then made, forming a deep slot with rounded bottom.

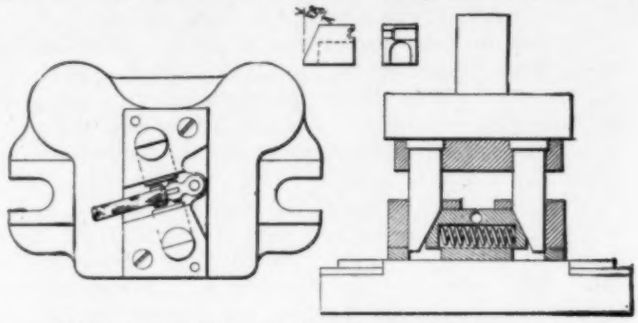
The wedge was then driven into the hammer and a short wood screw of suitable diameter started in the rectangular opening left in the center. The screw, which cut firmly into the wood on each side, I turned in beyond its threaded portion and until the point struck hard on the bottom of the wedge slot; after which the projecting portion was sawed off and smoothed over with a file, making a neat and permanent job.

A Unique Closing Die

By E. H. Tingley

The closing die shown in the accompanying sketch is used by the Delco-Light Company, Dayton, Ohio, for closing in the sheet copper or sheet brass clips around the ends of the electric wire leads of the switchboard, field coils or collector brushes. The clips are blanked, pierced and formed, and the electric wire is stripped of the insulation for about ½ in. from each end.

A supply of completed clips and of the stripped wire is supplied the girl operator of a No. 81 Consolidated press, in which the closing die is mounted, and she places a clip over a pin in the die. She next lays in the



CLOSING DIE FOR ELECTRIC WIRE CONNECTORS

end of the electric wire in the clip at the proper place (see sketch) and trips the press. The die blocks move inward and roll down the tips of the clips.

It will be noticed that the clip has two sets of tips, one which clamps around the bare wire, and the other to hold the cut end of the insulation, thereby preventing it from unraveling. The wire with clip attached is removed and solder applied to make a tight connection.

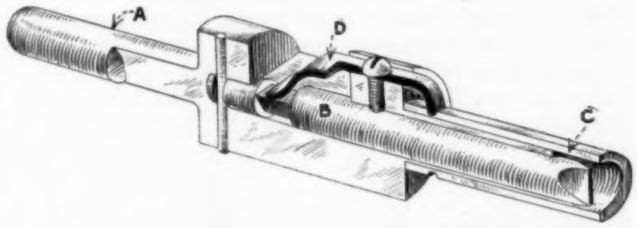
The design of the die is unique as it uses the principle of the wedge. The plunger rods are made of drill rod beveled to 25 deg., and the same angle is placed on the ends of the die blocks. A spring keeps the dies apart when the plunger rods are up out of the die.

This type of die has been designed and built for several sizes of clip and wire. Fromerly a pair of pliers were used to close in the clips, but the dies give a far neater and better result.

Setting Screws by Power in Assembly

By H. S. Beeston
Notts, England

The setting of screws and nuts, as referred to by Amos Ferber on page 739, Vol. 52, of the *American Machinist*, forms a great part in the assembly of electrical instruments. Many and varied are the methods used to boost the assembly, to keep abreast of the de-



TOOL FOR SETTING SMALL SCREWS BY POWER

mand. The writer desires to show a simple, efficient tool used for this purpose.

The tool may be used in a lathe or other horizontal spindle, but is much more efficient when used in a vertical position with suitable receptacles to hold the work and permit easy handling. As many as 7,000 No. 8-32 A. S. M. E. connection head screws have been assembled in terminal plates, springs and the like in an 8-hour day, the work being done by a boy.

Referring to the sketch, *A* is the toolholder, made of machine steel casehardened; *B* is the driver, made of tool steel and hardened. A three-sided section is filed

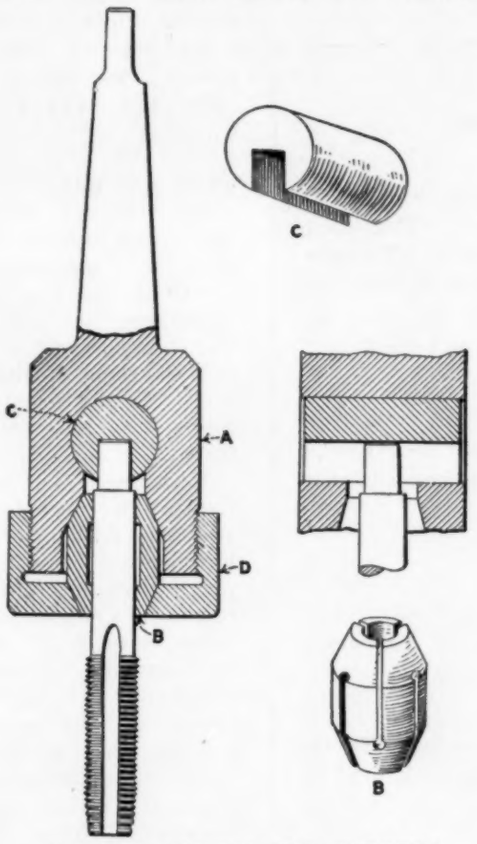
on it near one end, as shown; the sleeve *C* is made of machine steel and casehardened, fitting over the toolholder to locate the screw over the driver *B*. *D* is a tempered, flat steel spring, bearing at one end on the three flats on *B* and at the other in the groove in the sleeve *C*.

The action of the tool needs very little description. The operation of assembling screws is as follows: The screw is put into the sleeve *C* and the work placed over the screw. A downward push and the screw is home, the spring *D* riding over the flats of the driver *B*, which then remains stationary so as not to strip the threads or damage the finish on the screw heads. The tool may be run 2,000 or more revolutions per minute.

Tap Holder and Driver

By Frank W. Curtis

Many tap holders are so made, that the tap is only gripped on the shank and not driven by the square section intended for driving purposes. The tap holder



POSITIVE DRIVING TAP HOLDER

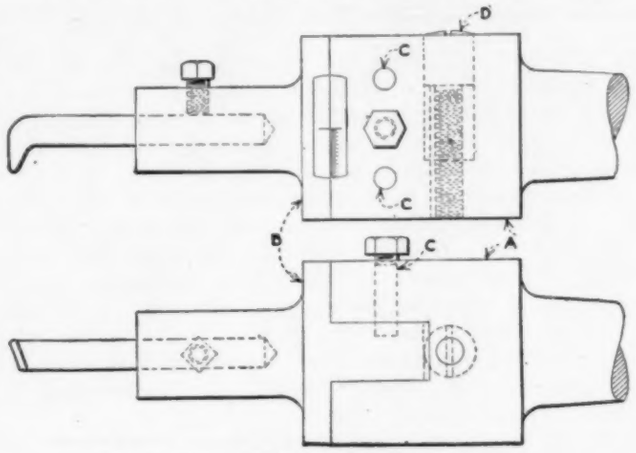
illustrated not only holds the tap by the shank but also drives by the square end. This holder can be used in connection with a friction tapping attachment and will avoid marring the shank.

The body or main section of the holder *A* can be standardized to hold various sizes of taps. The collet *B* and the driver *C* are respectively made to fit the shank and square end of the tap to be used. By screwing the cap *D* on the body of the holder, the collet grips the tap at two points. The driver *C* is pressed in the body and if it is to be removed for the substitution of other sizes, a taper pin can be used for holding it in position. This holder will give good service and can be made at small cost.

An Adjustable Boring Toolholder

By Harry Moore

A handy boring toolholder for use on the milling machine is shown herewith. It is made in two parts, *A* being turned to fit the spindle of machine and slotted



AN ADJUSTABLE BORING TOOLHOLDER

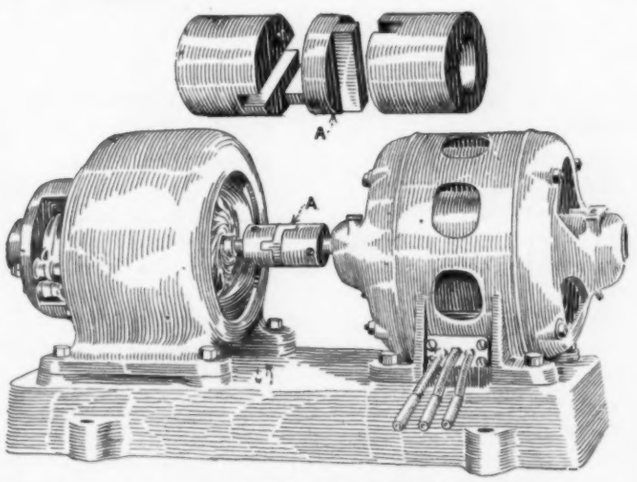
across the face to take *B*. This piece is in turn slotted or grooved for the pins *CC*. Part *A* is drilled and tapped for adjusting screw *D*, the head of which bears on the cut away portion of *B*, as shown. A flat milled across the top of both parts when together is afterwards graduated, this little addition making adjustment finer and easier. One screw only is needed for tightening purposes, the hardened pins holding the two parts in line.

A Simple Compensating Coupling

By Charles H. Willey

We had a motor generator charging set mounted on a cast-iron base, which gave constant trouble by reason of the bearings running hot, due to misalignment of the shaft.

The shop foremen made a quick repair by removing the solid coupling between the two units and cutting it



A SIMPLE COMPENSATING COUPLING

in half, machining in each part a slot and making a dutchman, as shown in the sketch at A, the lugs of the dutchman being a loose fit in the slots.

IN THIS ISSUE

THE leading article this week is the first of the series "Organization and Management of the Small Shop" by Elmer W. Leach, which we mentioned several months ago and have since referred to frequently. This article indicates that there is a whole lot more to the small shop than would ordinarily be thought. The author shows that we cannot get away from hard work any more than we could in the large shop and while it may appear to be a trite statement, it is nevertheless true that, as a rule, hard work and plenty of it is back of anything that is really successful. The point is emphasized that no matter how small a shop may be it must have an organization and a management just the same as must any large organization. The current article is, of course, to a large extent introductory. Future articles will take up methods and system. The author states that he plans to present a reasonable mixture of theory and practice, and that everything that will be offered is the fruit of actual personal experience and is not guess-work.

Another of the Rolls-Royce articles appears on page 85. Colvin has given it the title "Some Unusual Features of the Rolls-Royce Car" and has selected for description some of the details of design which are rather unusual in automobile practice, involving different construction and requiring special machining methods. He takes up the construction of the rear end of the chassis, machining operations on the control sphere, boring a torque tube; and boring and turning the rear axle tube.

We continue the dissemination of information for railroad shops with the article "Miscellaneous Railroad Shop Tools and Methods" by Frank A. Stanley, page 87. We have been running what may seem to some of our readers an abundance of railroad articles. Just because they are railroad articles is no reason why other than railroad men should not read them. They are representative of certain classes of work that are found in many shops. This particular one of Stanley's articles shows, among other things, a method for guiding taps and reamers, the design of an inexpensive high-speed steel reamer and the design of certain fixtures, all of them applicable to many kinds of jobs.

There have appeared in the past, two articles on the monitor and multi-storied types of shop which were two of the announced series on designs of buildings. The third of this group is the article beginning on page 91, on the high- and low-bay type of machine shop. Features of its design are the wide, high bays with low bays between, giving light from both sides, the use of standard columns and shapes, and the facilities offered for artificial lighting.

The third of the articles on the Puget Sound Navy Yard begins on page 94. It tells of a central tool grinding room, a system of sliding racks for storing milling cutters, and the handling of pneumatic tools. The short series "Manufacturing with Special Machines vs. Standard Equipment" which was introduced two weeks ago is continued this week beginning on page 97. This installment describes the first eleven operations performed on the sleigh forgings. Details of some of the tools are given and some of the special machines are illustrated.

With the subject of drill jig design concluded last week, the authors of "Tool Engineering" now take up the subject of milling fixtures. Throughout the group devoted to milling, the authors follow the method—so well established in the preceding articles—of furnishing many specific examples as well as giving general treatment. They do not fail to point out conclusions that have been drawn or can be used as a basis for establishing rules. At the same time, the articles contain the proper amount of theory, a feature that will appeal to the thinking reader. This week's installment begins on page 102.

No one should fail to carefully read the News Section this week. On page 120 is the "Business Barometer," a new feature that appeared for the first time last week. The object of this barometer is the same as that of any other, namely to indicate what is coming. There are also reports on business conditions in Germany, Russia and France and there is, in full, the address delivered by Herbert Hoover before the National Shoe and Leather Exposition and Style Show.

Coming Features

The next issue will be largely devoted to complete articles, among them, "Balancing High Speed Rotors," by A. Schein; "Transfer Dies for a Shallow Cup," by Frank A. Stanley; "Machining Transmission Cases," by Fred H. Colvin; and "Trade Associations and the Law," by Frank K. Nebeker.

The fourteenth of the Dowd and Curtis "Tool Engineering" series will continue with the subject of milling fixtures.

The fourteenth of the Morris apprenticeship articles will detail the various apprentice and training courses of the Winchester Repeating Arms Co.

The thirteenth of A. L. DeLeeuw's "Metal Cutting Tools," devoted to boring tools, will be a part of the issue.

EDITORIALS

Coal—Is This the Time to Buy?

THE mercury in the thermometer seems to have made up its mind to settle down to an average of 90 in the shade for some weeks to come. Consequently it is time for the forehanded manager to consider the condition of his coal pile and to plan for the cold weather that will be here six months hence.

In any year the problem of how much coal to lay in and when to buy is not easy of solution, but this year with almost everything doing precisely what it shouldn't it is worse than ever. We hesitate to give advice in such a case but we feel that it is distinctly within our province to present the facts as they are.

At the present time prices are down, 'way down. Taking the index figure established by the Government Fuel Administration on the basis of cost of production at 100, the present index is 89. As a result not a great deal of coal is being mined for the simple reason that most of the mines, where the cost of getting out the coal is relatively high, have been forced to close down. Just as soon as there is an increase in demand the amount now being mined will be insufficient, it will be necessary to call upon the high cost mines to produce it, and prices will stiffen. The old law of supply and demand will operate as usual.

One reason for the present low prices is the fact that certain non-union mines, which ordinarily do not produce coal for sale to the public but only for the industries which own them, are now mining coal for sale while the industries are closed down. They seem able to undersell the union-operated mines by about a dollar. The amount of coal they can produce is not large and will be withdrawn from the market just as soon as there is any sign of improvement in the industries which these mines normally serve and immediate stiffening of prices will follow.

There has been some hope that the union mine workers would listen to reason and agree to a voluntary reduction in wages but it seems likely that they will insist upon the fulfillment of the national agreement which runs until next spring, and remain idle rather than work for less money. As the f.o.b. cost of steam coal is approximately 70 per cent labor the chance of any appreciable reduction in price is slim.

On the average about half of the cost of coal to the consumer is transportation charges. There is no doubt that freight rates are high and that certain adjustments should be made. As a matter of fact, however, the great majority of adjustments that have been made in coal rates have been up and not down. There is much talk of reducing freight rates but with the railroads in their present financial condition there is little chance of relief from this direction.

The man who has laid in his winter reserve of coal can devote his energies to solving others of the many problems that beset him, but the man who is sure to need coal before the first of July next will do well to face the facts squarely and make his decision accordingly.

Organization and Management of the Small Shop

THE series of articles "Organization and Management of the Small Shop" of which the first installment appears in this issue, will answer a question which has been asked, either verbally or mentally, thousands of times—"Can I compete with established businesses?" The origin of every great business was an idea, and practically every one of our greatest industries started with decidedly meager equipment and facilities.

The author lays stress on the necessity of organization in the small shop and discusses manufacturing and marketing problems, citing his own experience as an example. Many a potential industry has been lost to the world because of lack of faith and confidence, and many are the ventures that have failed because of lack of competent counsel.

Mr. Leach takes up each phase of development in detail, covering the subjects of equipment, organization, market analysis, selling the product, and sales policy, in a manner which will undoubtedly be valuable to the man who has created, mentally at least, something that will fill a definite want.

Special Equipment vs. Standard Machine Tools

ALTHOUGH the series of articles which began in the issue of July 7 deals with the making of the recuperator for the 240 mm. gun, this is not the object of their publication. The real object is to give a direct comparison between the use of special equipment in one shop, with the use of standard machine tools in another shop, on identically the same work.

This is clearly brought out in the introduction by Col. G. F. Jenks, Chief of Artillery Division of the Ordnance Bureau. He points out the differences between the two systems, the machines employed and the results obtained. It should also be noted that in both cases the men selected for the work were among the best obtainable, so that the comparison is evidently as fair as could be made. As is to be expected, the advantages of either method apparently depend upon the quantity to be built.

The first portion of these articles will show the special machines designed and built for this work and the way in which the work was handled. The data given are particularly valuable from the fact that they point out just the kind of things which the practical shop man wants to know. The second portion will show the use of standard machine tools, supplemented, of course, by special tools and fixtures as would be the case in any well-managed shop.

These articles cannot fail to prove of great value to all who are interested in the modern use of machine tools, and who realize that success comes to those who can adapt the ideas of others to their own needs, rather than by waiting for something which can be copied without charge.

Shop Equipment News

Poliakoff Milling Machine Dynamometer

In order to determine the pressure exerted by a milling cutter at work, the Poliakoff dynamometer, shown in Fig. 1, has been devised. The device has just been

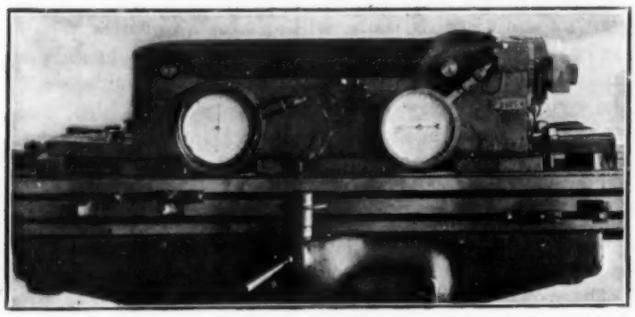


FIG. 1. POLIAKOFF MILLING MACHINE DYNAMOMETER

placed on the market by the Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio. The dynamometer is intended for mounting on the machine table, to hold the piece being cut. The pressure of the cutter on the work is shown by means of dials, one of which gives the vertical and the other the longitudinal thrust.

The device should be of particular use in comparing the pressures exerted by different types of cutters, as well as in determining the stresses set up in the milling machine itself, so as to aid in properly designing its parts. It gives much more definite data regarding the conditions at the cutter than can be obtained by measuring the input to a motor direct-connected to the machine being tested. The reason is that the thrusts in each direction can be accurately determined by means of the dynamometer, and because the efficiency of the driving train in the milling machine, which, of course, varies for different speeds and feeds, does not enter into the test as it does when measuring the power input only.

The work-holding platen of the dynamometer is supported at each end by a wide "Emery" plate fulcrum, the lower end of which rests on two levers, which carry a definite portion of the vertical load on the platen to an hydraulic chamber placed centrally under the work table. This chamber is connected with the left-hand gage, which is graduated by trial in terms of the vertical load in pounds.

The horizontal load is transmitted through bars which are flexible vertically, to the crosshead seen at the right in Fig. 2, which illustration shows the device set transversely on the table, so as to measure the thrust of the helical cutter parallel to the arbor. The crosshead transmits the load to the hydraulic chamber between the crosshead and the end of the main frame of the dynamometer. This chamber is connected to the right-hand gage by the pipe. Heavy springs are used to put initial loads on each chamber, so that they will show loads in either direction.

The Emery plate fulcrums carrying the loads to the levers are so constructed as to be rigid against vertical and cross loads but flexible to longitudinal loads, and the bars to the crossheads are flexible to vertical loads, so that neither system interferes with the action of the other. Guards are provided, so that any desired lubrication or flooding of the cutter may be used.

The dynamometer has the capacity to withstand longitudinal loads of 25,000 lb. in one direction and 4,000 lb. in the opposite direction, vertical downward pressures of 10,000 lb. and upward pressures of 7,000 pounds.

The working surface of the table is 16 in. long by 10 in. wide, and is provided with three T-slots. The height of the working table above the bottom of the base is 8 in. The total size of the base of the dynamometer is 35 x 14 inches.

The dynamometer will be found particularly valuable to manufacturers using extensive milling machine equipment, as an aid to the study of milling operations and the action of milling cutters, thus enabling them to definitely determine the exact requirements of milling jigs and fixtures, a knowledge of which is so essential for their correct design. It will also be found valuable for shops where milling operations are studied, as in experimental shops, laboratories, and shops of technical schools and colleges. Problems attending standardiza-

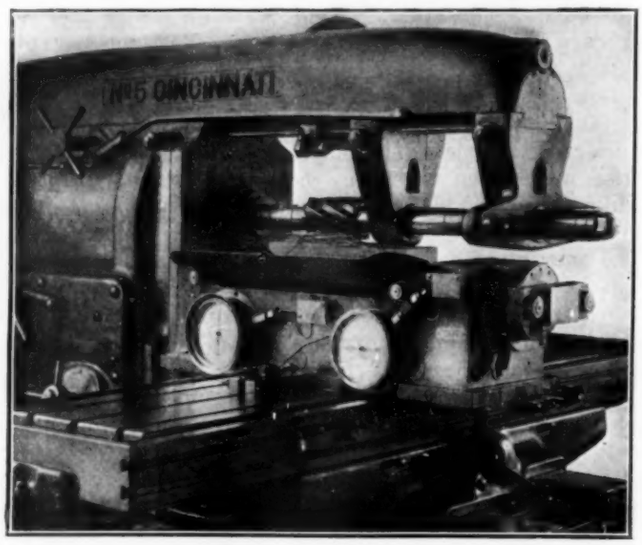


FIG. 2. DYNAMOMETER PLACED TRANSVERSELY ON MACHINE TABLE

tion of machines and cutters can be more readily solved with its aid.

The instrument is said to have proved extremely satisfactory and to be very sensitive under tests. Quite obviously, its use is not confined to milling machines, but it is equally adaptable for making tests on planers, shapers and, with slight variations, on drilling machines.

General Electric Arc-Welding Generator Sets

The General Electric Co., Schenectady, N. Y., has recently placed on the market two types of gas-engine driven arc-welding generator sets, one for medium, or intermittent duty, and the other for heavy duty. Both

outfits are well adapted to industrial plants where the work to be done is located in odd places, and is not sufficient to warrant the installation of permanent equipment. Their particular field, however, is in places where electric power is either unavailable, or inconvenient or costly to bring to it, such as in marine work, or for welding experts who travel about in localities where there is no electric power.

The medium-duty equipment, shown in Fig. 1, was designed particularly for intermittent work. The generating unit consists of a type WD-10 generator, directly connected by a flexible coupling to a Matthews, Model F, 4-cylinder, 4-cycle, 20-hp. gasoline engine. The engine, radiator, generator and welding panel are assembled on a rigid cast-iron base, which, in turn, is mounted on wooden skids. The set is 86 in. long, 28 in. wide, and has a net weight of about 2,000 lb., making a light and compact affair to move about. The gas engine used with the outfit is said to be especially adapted to the requirements of intermittent welding service. It is of the overhead-valve type, the cylinders being cast in one block with the upper half of the crankcase. The lubrication is a combination of splash and forced feed, and the cooling thermo-siphon, except where special conditions require the addition of a pump driven by the accessory shaft.

The generator is self-exciting and regulating, giving practically constant energy throughout the working range. It gives a no-load, or striking voltage of 60, which automatically decreases to the proper welding voltage, usually 18 to 20 volts, when the arc is struck. It is driven at a speed of 1,200 r.p.m., has a normal output of 4 kw. and delivers a maximum working current of 200 amp. The panel carries the generator field rheostat and series field dial switch, by which the current can be adjusted from 200 to 75 amp. in 25-amp. steps. A reactor choke coil mounted on the set and connected in the welding circuit protects the generator from current surges.

The heavy-duty equipment, shown in Fig. 2, can be arranged to supply either one or two welding circuits. It consists ordinarily of a 20-hp., 2-cylinder, opposed Reliable Heer, Model 00 gas engine, a type WD-9 generator and welding panel, the whole mounted on a welded structural steel base. The net weight is 2,400 lb. for the single-operator equipment, and 3,200 lb. for the double-operator equipment.

The gas engine is designed for continuous operation at the rated output. Careful balancing is said to practically eliminate vibration, and the horizontal cylinder and relatively small flywheel make possible a compact assembly with the rest of the outfit. It will run on kerosene, distillate, gasoline, or natural or artificial gas, with a fuel consumption per brake-horsepower not exceeding 1 pint of kerosene, distillate or gasoline, 10 to 12 cans of natural gas, or 17 to 22 ft. of average illuminating coal gas.

The generator is driven by a silent chain running in oil, and, except for the speed, its characteristics are similar to the WD-10 generator used in the medium-duty outfit. It runs at 1,750, instead of 1,200 r.p.m., and differs somewhat in the windings because of the difference in speed and service requirements. An ammeter is mounted on the panel of the heavy-duty machine, but in other respects the electrical equipment is identical with that of the medium-duty set. A mere change of location constitutes the only difference between the reactors of the two sets.

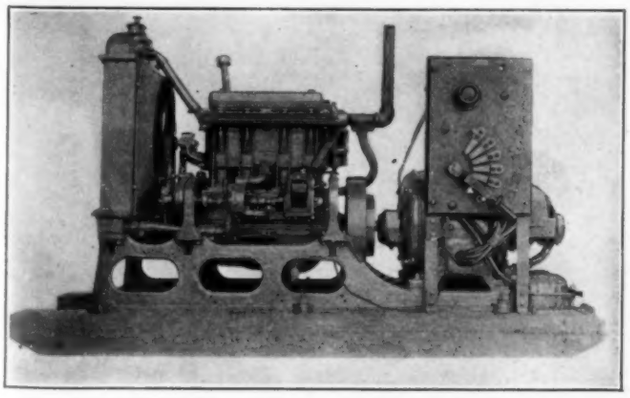


FIG. 1. G. E. MEDIUM-DUTY WD-10 ARC WELDING GENERATOR SET

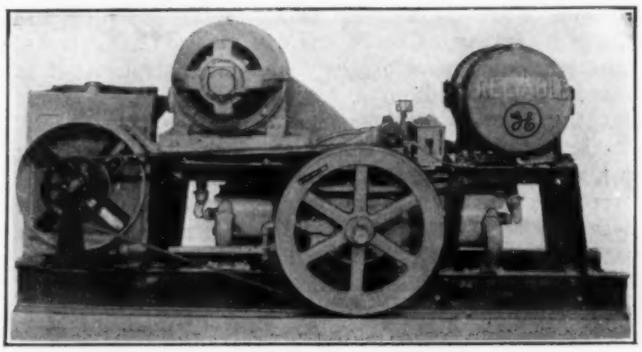


FIG. 2. G. E. HEAVY-DUTY WD-9 SET

Pearson-Scott Mechanical Control for Hand Screw Machines

The Pearson-Scott Co., 1523 East Washington St., Indianapolis, Ind., has recently developed a machine for attachment to a hand screw machine, so as to make the operation automatic. Since the machine does mechanically the work ordinarily performed manually by the operator, it is known as the "Iron Man." It is designed so that it is suitable for placing either at the turret end of the screw machine or at the head end, the latter arrangement being shown in Fig. 1. The machine has means at both ends for the connection of the working arms and reach rods to the control handles on the screw machine, so that it is not necessary to turn it around to connect it. Also, the "Iron Man" can be set between two screw machines working on the same part, so as to control both of them at the same time.

The appearance of the interior of the mechanism after the removal of the oil guards on the front side of the machine is shown in Fig. 2. The essential element of the machine is the large worm-driven disk, upon the sides of which cams can be mounted, their positions being indicated by the light-colored spots. The disk is drilled and tapped with a number of holes for the attaching of the cams. This saves the time of the operator in fitting up the machine, as he usually finds sufficient holes already drilled and tapped for the needs of the job.

The cams run in an oil trough in the base of the machine. They operate to press against hard steel rollers carried on the horizontal crosshead, causing this crosshead to slide back and forth on the finished guide at the center of the machine as the disk revolves. The

motion is conveyed to the screw machine controls through a combination of levers. There are six of these levers, located on both the front and rear sides of the disk, and the cams are set on both sides, one set operating the turret slide and the other the collant and return mechanisms. These different cam motions either start, reverse, or stop the machine and throw the back gear in or out, as required by the operation on the work being handled. The turret is indexed, and cutting-off and forming tools operated as desired.

A special feature of the machine is the stock-feed unit, which can be adapted to any screw machine. It affords a continuous speed and can give a 12-in. stroke, if necessary, instead of the 3- or 4-in. stroke that is ordinarily provided on a hand screw machine. This unit is separate and distinct from the "Iron Man" attachment, as is also the turret lock and die-setting unit, which automatically locks and unlocks the indexing turret and sets the die for chasing threads. Either of these units can be attached to any make of screw machine. The stockfeed unit makes it unnecessary for the operator to leave his position in front of the screw machine and go to the stock end to change the stock.

A particular feature of the device is the arrangement

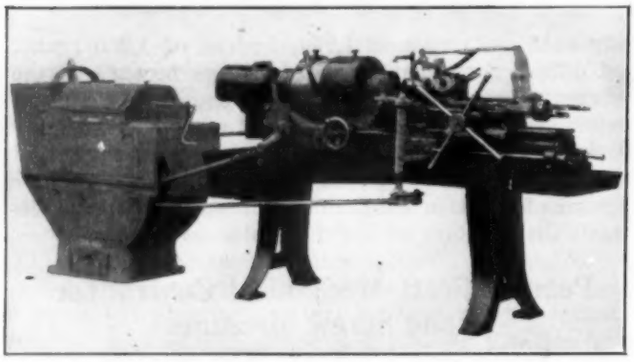


FIG. 1. PEARSON-SCOTT "IRON MAN" CONTROLLING HAND SCREW MACHINE

for changing the speed of the drive from the countershaft to the device, in order that the worm may be speeded up during the idle periods of the screw-machine turret. Thus, high speed may be used when moving the turret tools to the work and withdrawing them, but a slow speed should be used while cutting.

The speed of the attachment is always under control from high to low by means of buttons placed on the ring gear. The design of the countershaft allows for speed variation to suit the material being cut. In case of clogging of the parts, or shaving or slipping of the belts of the machine or any other such emergencies, a safety pin shears to prevent damage to the machine. Practically all the cams used for the majority of operations are furnished, and special cams can be very cheaply made.

As many as four complete cycles can be set up on the camplate at one time, when operating on pieces that require only one or two cuts from the turret tools. In case a turret must carry working tools on all sides, the camplate will be practically filled with cams, each one engaged in controlling some one of the various operations. When the camplate is not filled, it will run at high speed through that portion of the cycle where it is not carrying operating cams. When setting up the machine, the operator can slowly turn it over by means of the hand crank.

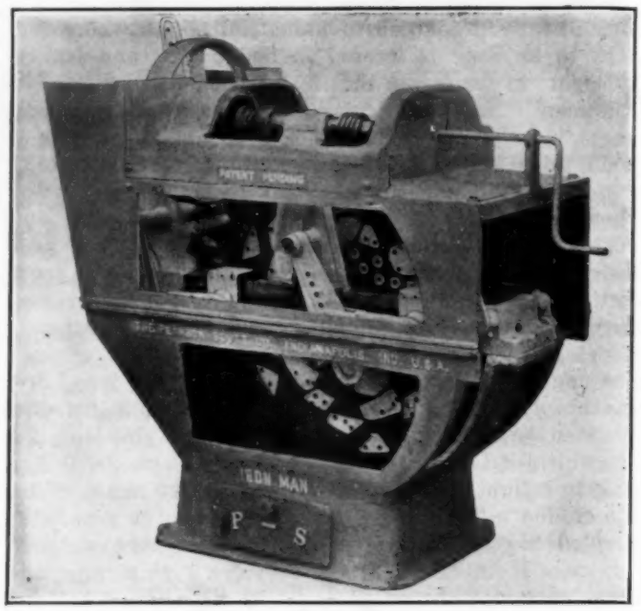


FIG. 2. MECHANISM OF THE "IRON MAN"

The reach-rods can be disconnected in a very few minutes and the screw machine can then be operated by hand in the same manner that it was previous to setting up the attachment. The throw levers are provided with a number of holes extending throughout their length, to permit adjusting the reach-rods for different lengths of throw. Each reach-rod is also provided with a joint, that permits accurate adjustment of the depth of cut.

"Supreme" Universal Drilling, Boring and Milling Attachment

A fixture for attachment to a milling machine and for use in drilling, reaming, boring and milling has recently been placed on the market by the Supreme Machine and Tool Co., 1738 St. Clair Ave., Cleveland, Ohio. The device is intended especially for jig boring; and it is said to eliminate the necessity of figuring and checking the angles on the work in the toolroom, of buttoning the jig, and of moving the work.

The attachment is arranged to fasten on the column

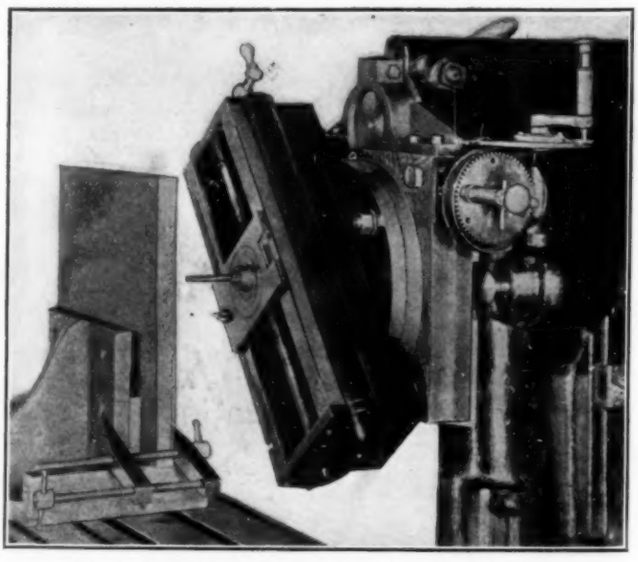


FIG. 1. "SUPREME" UNIVERSAL BORING AND MILLING ATTACHMENT

and overarm of a milling machine, as shown in Fig. 1, the base, of course, being adapted to the particular size of the milling machine to be used. The boring spindle is driven from a main gear which is adapted to the spindle of the milling machine, and it drives the spindle of the attachment through bevel and spiral gears. The movements of the traveling spindle are two, radially in a slide which, in turn, has a circular movement imparted by a series of worms and gears, so that any angle can be obtained. The attachment is self contained and easily attached, and when in place it forms an integral part of the machine. It does not extend beyond the spindle of the milling machine any more than the ordinary drill chuck or boring toolholder.

The work is clamped on the milling machine table, the starting hole located, and the knee and table are then clamped, all further movements being made by the attachment itself. In Fig. 2 is shown a job done on the machine. It is a jig plate, the maximum allowable error being 0.002 in. It is said that the time taken to make the plate was reduced 85 per cent by using the attachment. Graduating to a fine degree and the machining of old cams and shapes are stated to be easily performed by the device. A feature of the tool is a chart which, when set at any desired angle, reads on the opposite side the exact movements of the driving gears necessary to set the boring head at the required angle. No other figures are visible and there is, therefore, no chance for the operator to misread the directions. The chart eliminates all necessity for calculation of the angles and distances.

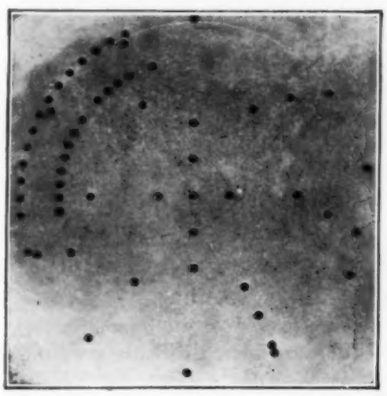


FIG. 2. JIG PLATE DRILLED BY MEANS OF THE ATTACHMENT

Any angle to the second may be obtained by the dividing apparatus. The radial adjustment is made by means of a venier scale; and the angular adjustment is made by means of the chart especially designed for the machine. The spindle is provided with taper front bearings adjustable for wear, and provision is made to keep back-lash out of the dividing worms. It is claimed that great accuracy is obtainable, due to the tool moving around the stationary work.

The attachment will do any work of circular form, and a great many operations requiring irregular shapes and locations; and fine or accurate movements are more readily obtainable than on either a vertical or a horizontal milling machine where the work and the weight of the knee and table must be moved. On account of the lightness of the moving spindle, it is not liable to settle, as does the spindle of a large machine, and the work can be checked from the preceding operation

Whiting Short-Turn Overhead Trolley System

The Whiting Corporation, Harvey, Ill., has recently placed on the market an overhead trolley system for the carrying of chain blocks or hoists. The track itself consists of two parallel, standard, rolled channels, spaced 2⅛ in. between the flanges and held in place by clamps. The track is designed to carry loads with no intermediate supports, except at the splices, corners and switch points. In making a long span, as over a driveway or from one building to another, a heavier section of channel can be used.

The apparatus is known as the "Short-Turn" trolley system and consists of the standard channels, turns, 90-deg. right or left switches, 45-deg. right or left switches, and the universal switches. The illustration shows a view looking up at the track equipped with a series of universal switches. Each corner and switch connection is interchangeable, so that at any time a corner or turn can be removed and a double switch or universal switch be bolted in the same place.

All of the corners and switches have a track curvature of 18 in. This is especially adaptable to foundries, as when serving a row of brass furnaces or machines

WHITING SHORT-TURN OVERHEAD TROLLEY SYSTEM

close to the wall, without losing space by long curves It is also particularly adaptable to use in freight and terminal houses. The track is built, shipped, and can be erected in units.

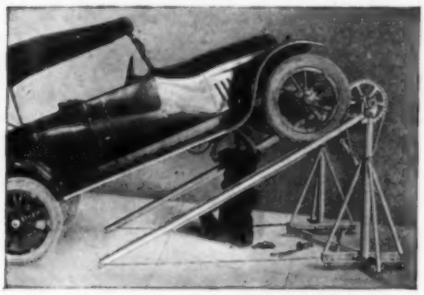
The hoist is carried on either 2-, 4-, or 8-wheel trolleys. The trolleys have ball-bearing wheels and guide rollers, which latter run between the toes of the channels, preventing the wheels from binding against the track when rounding the curves. The wheels of the trolley run on the level tops of the channels, and its design permits it to swing in the 18-in. radius curves. The system can also be readily wired, should it be desired to use an electric hoist in place of a chain block.

The fact that the track is built from standard channels, or can be built from I-beam sections where long spans and greater strength is required, makes it easy to obtain from local stocks and easier to erect. The whole system is said to be so designed that it is impossible for the trolleys to run off the track or go in a direction not pre-determined.

Manley Floor-Level Under-Worker

The illustration shows in use a device recently placed on the market by the Manley Manufacturing Co., York, Pa., for use in automobile repair plants. It is intended for elevating either the back or the front end of an automobile, so as to give access to the under parts of the chassis. Its use eliminates the necessity for a pit in the floor for the doing of work on the under side of a machine. The mechanic using the under-worker is on the floor level of the shop, so that the work of getting in and out of a pit to obtain tools or parts is obviated.

The mechanic can work in a sitting position and with the job in front of him, varying the height of the machine to suit his convenience. The position permits light to reach the parts. Because of the ease with which the automobile can be raised, it is said that the use of a creeper to enable the mechanic to get under a car in a prone position is desirable for only very minor adjustments. The device is fitted also for use on the washing stand, to enable the proper cleaning of the under side of the car. The under-worker is made entirely of metal, and is said to have a large factor of safety. The two tracks on which the wheels of the automobile rest are 6-in. channels stiffened at the middle. The two uprights are of 2½-in. steel pipe resting on angle-steel bases, each braced in three directions and mounted on three ball-bearing casters. Tie rods fasten the lower ends of the channels to the bases, to prevent the channels from slipping. The distance between the tracks can be varied, so as to permit of use for wide-tread cars.



MANLEY UNDER-WORKER FOR AUTOMOBILES

A double crank on one of the uprights is used to rotate the top horizontal member of the frame, through a chain and sprocket. This action winds around the member a heavy chain attached to the axle of the automobile and pulls the machine up the incline. The car is prevented from running back by means of a ratchet and pawl.

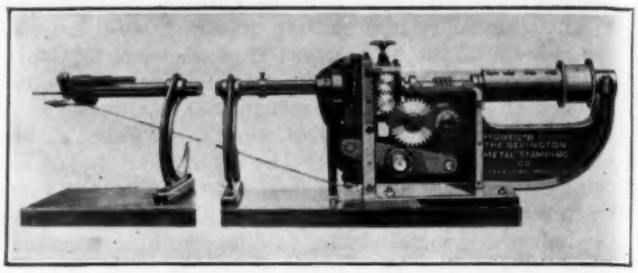
The tracks can easily be removed from the under-worker so that the device can be put out of the way, requiring but little space. The under-worker can quickly be moved wherever desired, so as to work on a car in any part of the shop, only one man being required to handle it.

Specifications: Length of channels, 9 ft. Height of chain drum, 4 ft. 10 in. Length of operating handles, 22 in. Length of base angles, 30 in. Overall width; for 56-in. tread, 88 in.; for 62-in. tread, 94 in. Net weight, 450 lb.

Bevico Automatic Wire Straightening and Cutting Machine

The accompanying illustration shows a phantom view of the "Bevico" Model "B" automatic wire-straightening and cutting machine recently placed on the market by the Bevington Metal Stamping Co., 1545 E. 18th St., Cleveland, Ohio. The machine handles round wire directly from the coil. It is driven by a single belt. Norma ball bearings are used for the arbor, and interchangeable bronze bearings for the other parts, so that the machine runs easily.

An operator can attend to several machines at once.



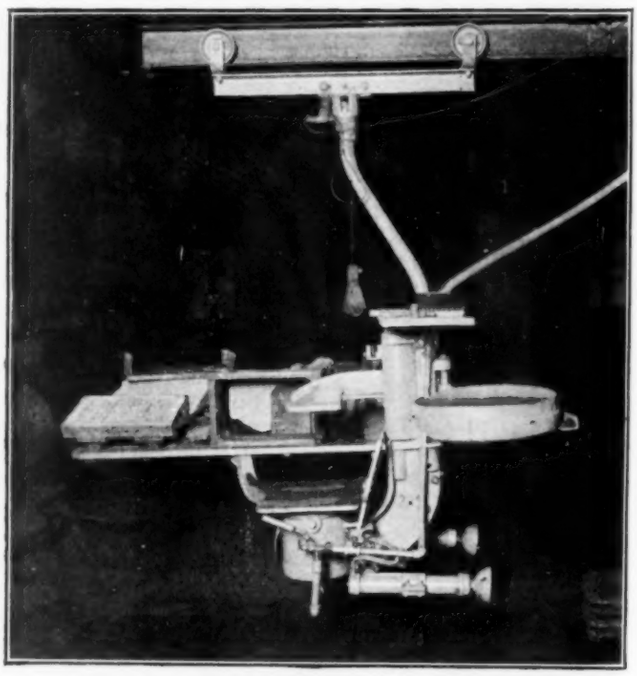
BEVICO MODEL "B" AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE

The machine is said to be compact, simple, durable and fool-proof, to be noiseless in operation, and free from vibration. The feed rolls and cutting dies are made of heat-treated tool steel. The straightening dies are either gray iron, wood, babbitt or brass, depending upon the kind of wire to be handled.

The Model "B" machine handles wire from No. 20 W & M gage to $\frac{1}{4}$ in. in diameter, cutting it automatically into lengths from 6 in. to 4 ft. The machine can be furnished to cut any length of wire, however, and machines of the same design are built to handle wire from No. 30 W & M gage to $\frac{3}{4}$ in. in diameter. The width of the machine is 12 in., and the length 24 in. plus the length of the wire to be cut. It requires $\frac{3}{4}$ hp. to operate it, and it weighs 250 lb.

Howe-Teetor No. 9 Molding Machine

The R. J. Teetor Co., Muskegon, Mich., has recently made some changes in the design of its No. 9 molding machine. The illustration shows the machine suspended,



HOWE-TEETOR MOLDING MACHINE NO. 9

the trolley wheels running on roller bearings, so that the machine can be moved along as the row of molds is made. The device can be swung about a vertical axis.

The machine can be supported from the floor by means of two legs operated by compressed air. In operation, the air is admitted into the legs, thus creating an upward pressure of approximately 500 lb. to stabilize the machine and hold it rigid. When it is desired to move the machine, the air is released and the feet are drawn up by means of springs contained within the air cylinders in the legs, thus allowing the machine a clearance of from 4 to 5 in. above the floor. If it is desired to move the machine over molds, the legs may be turned into a horizontal position, as shown, giving a clearance of 19 in.

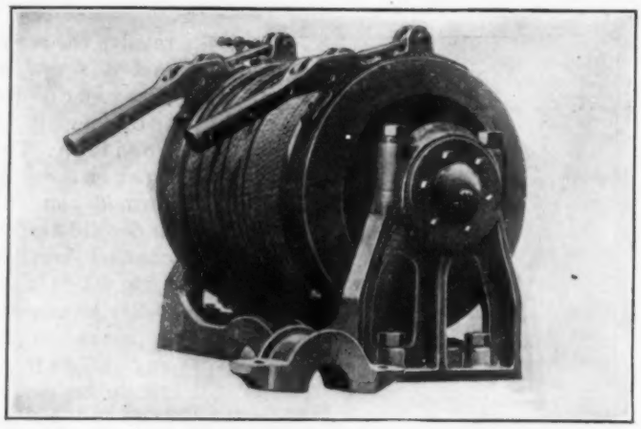
The squeezer platen is a malleable-iron casting mounted on a 2-in. shaft pivoted between point centers in the main casting of the machine. It has a vertical adjustment of 6 in., to provide for different heights of flasks. The cylinder and column are cast in one piece. The side bench at the left of the machine is rigidly attached to the main casting and provides room for the molder's cores, patterns, flasks, match, parting sand and tools. At the right of the machine is a swinging riddle shelf, pivoted vertically, so that it may be swung over the mold in position for riddling sand onto the pattern. The plain squeezer may be adapted to stationary work. It is mounted by means of two vertical steel angles, bolted to the column and set in concrete. The construction of the stationary unit is such that, should it become desirable at any time to mount it for portable use, it can be done with merely the addition of the necessary equipment and with no changes in the squeezer itself.

Sullivan "Turbinair" Hoist

The accompanying illustration shows the air-operated hoisting engine recently placed on the market by the Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill. The device, known as the "Turbinair" hoist, is intended for general hoisting or hauling work, being so compact that it may be mounted in a very small space. It is stated to be very powerful, considering its size, having a capacity of 1,500 lb. dead load lifted at 100 ft. per minute, using an air pressure of 80 lb. per square inch. It is stated that the hoist can be very easily controlled.

The hoist is simple in construction, although of unusual design. It consists primarily of a cylindrical drum, mounted on a steel frame and completely enclosing the operating mechanism. This mechanism, consisting of a motor and reduction gearing, drives the drum shell. The motor is said to be the same in miniature as that used on the Ironclad coal cutter made by the same concern. There are two cylindrical rotors, each provided with right- and left-hand helical flutes converging to a spur tooth in the center. The rotors mesh together, and are caused to revolve by the pressure of the incoming air, which is admitted at the axis of the drum through a hollow shaft. The motor is said to have a high starting torque, to be economical in the use of air, since it is used expansively, and to show a long life and sustained efficiency.

The hoist is provided with a friction clutch and brake. When both are released, the rope may be pulled freely from the drum. The friction clutch may be locked in position and the load raised or lowered, being controlled entirely by the throttle valve. The brake is of the band type and is of sufficient strength to hold any load within the capacity of the hoist. Ball bearings are employed, and all mechanism is totally enclosed. An automatic oiling device is provided to lubricate the rotors. The hoist is said to be very quiet in its operation.

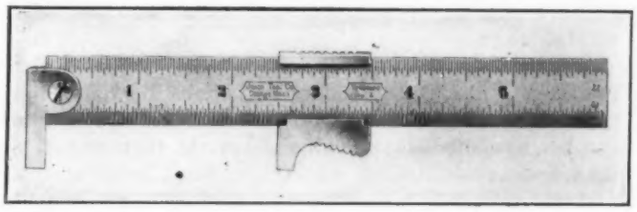


SULLIVAN "TURBINAIR" HOIST

Specifications: Capacity at an air pressure of 80 lb. per square inch, 1,500 lb. vertical lift. Speed at maximum load, 100 ft. per minute. Capacity of drum, 500 ft. of $\frac{7}{16}$-in. wire rope. Hose or pipe connection, $\frac{3}{4}$-in. Horsepower, $4\frac{1}{2}$. Drum: diameter $9\frac{1}{2}$ in.; length $9\frac{1}{2}$ in. Height, $15\frac{3}{4}$ in. Floor space, 22 x $13\frac{1}{2}$ in. Net weight without rope, 285 lb.

"Union" Machinists' Caliper Rule

The Union Tool Co., Orange, Mass., has added to its line the caliper rule shown in the accompanying illustration. The slide is held to position on the rule by the tension of an elliptic spring and may easily be moved in either direction by the pressure of the thumb. The slide is ground to exactly 1 in. in length, and beveled edges are provided at each end to facilitate reading the scale. When reading from the outer end, allowance is made in the number of full inches for the length of the slide the fraction indicated being the same at each end.

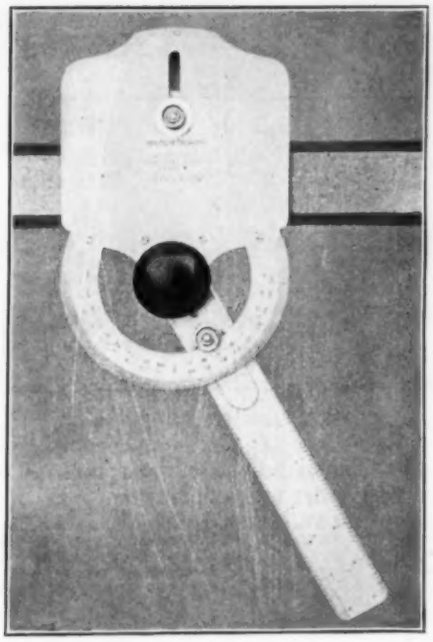


"UNION" MACHINISTS' CALIPER RULE

Turner "Protractagraph"

The drafting instrument shown in the accompanying illustration has recently been placed on the market by Turner Devices, Inc., 5 South Newstead Ave., St. Louis, Mo. The instrument is intended to take the place of the usual drafting tools, such as triangles, scales and protractors; and it is said to be a combination of all of these tools, so that the draftsman has but one instrument to handle when making a drawing.

The device is intended for use with any parallel-ruler attachment on a drawing board, being shown in the illustration clamped to the straightedge. It consists primarily of a plate formed at its lower end into a semicircular protractor graduated to $\frac{1}{2}$ deg., the working arc being 180 deg. Various scales and a transparent amber inking blade, all of which are easily detachable and when in use are held in position on a plate pivoted at the center of the protractor arc, are furnished with the machine. A knob on the axis of the device is used to



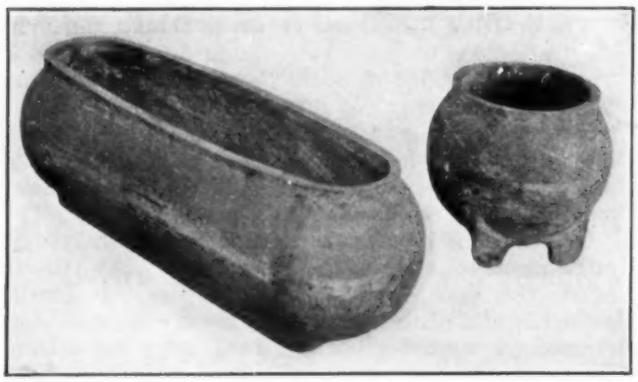
TURNER "PROTRACTAGRAPH"

revolve the scale, and a screw is provided for locking it in position. The instrument is formed on its under side into a channel section, the width of which can be adjusted to fit any width of straightedge, so that the instrument can slide along the blade without lost motion. The combination of the longitudinal movement of the machine on the straightedge and the lateral movement of the latter, enables the instrument to be manipulated to any part of the drafting surface. When working near the top of the drawing board, the machine can be reversed so that the scale and the protractor are above the straightedge.

The parts of the instrument are made of nickel-plated metal, or of white celluloid, the knobs being of hardwood. Scales having any number of standard divisions can be furnished. It is claimed for the instrument that its use makes drafting work more easy, more accurate, and more speedy, because of the fact that it is not necessary to change from one instrument to another while performing the work.

Pioneer Carbonizing and Case-Hardening Boxes

The Pioneer Alloy Products Co., Cleveland, Ohio, has recently placed on the market a line of carbonizing and case-hardening boxes made of a patented heat-resisting alloy steel. The boxes are cast in any size or shape desired. However, square and rectangular



PIONEER CASE-HARDENING BOXES

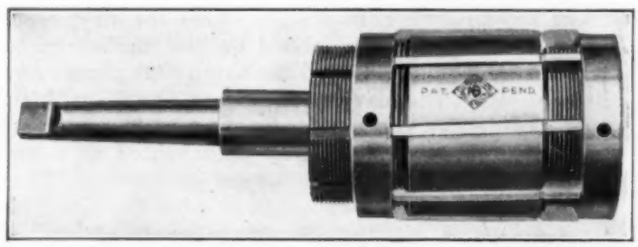
boxes are not used, because of the fact that they are more apt to crack. The small round box shown on the right of the illustration is 13¾ in. inside diameter, 20 in. overall in height, has a 10-in. opening at the top, and weighs with the cover 108 lb. The long box of cylindrical shape, shown on the left, is intended for the heat-treating of camshafts. It is 34½ in. long and 12½ in. wide on the inside, the height overall being 12¾ in., and the inside radius 5¾ in. The weight with the cover is 280 lb.

The material from which the boxes are made is an alloy steel containing sufficient chromium to make it practically non-oxidizing. The merits of the box and its long life are said to be due not only to the alloy used but to the shape employed. The cylindrical or circular form allows the box to expand and distort, due to temperature changes, without the liability of producing cracks. In boxes made with flat sides there are planes of weakness caused by the crystals of the metal forming at right-angles to each other at the corners. Cracking is, then, a result of this inherent weakness, when stresses and warping result from temperature changes.

New Britain Pilot-Blade Expansion Cylinder Reamer

The New Britain Tool and Manufacturing Co., New Britain, Conn., has added to its line a set of expansion reamers for reaming the cylinders of gas engines, particularly automobile engines, and will carry in stock sizes suitable for the more popular makes of cars.

The reamers are designed to be used in pairs, a roughing and a finishing reamer for each oversize.



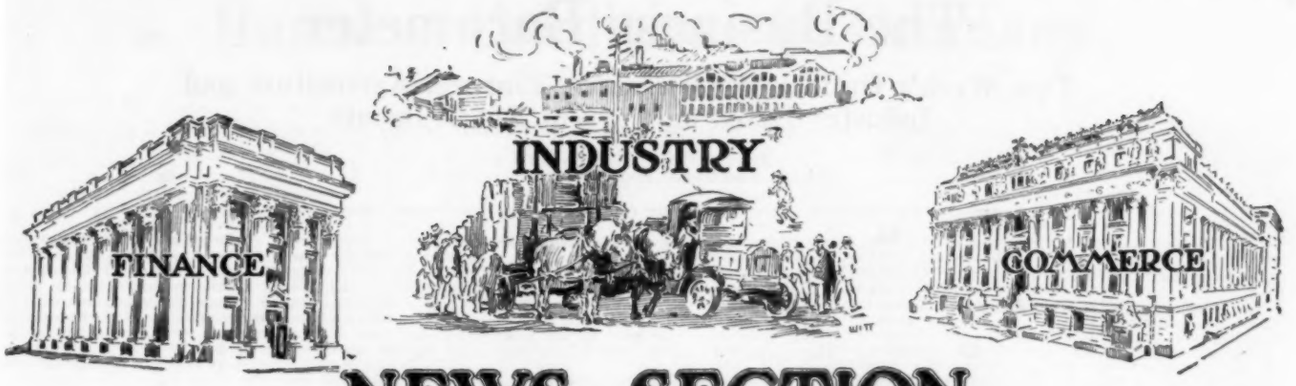
NEW BRITAIN PILOT-BLADE REAMER FOR GAS-ENGINE CYLINDERS

The pilot portion of the roughing reamer, shown in the illustration, is ground to fit the normal bore of the cylinder with which it is to be used, while the cutting portion of the blades is so made as to remove about 0.030 in. of stock. Similarly the pilot of the finishing reamer follows the bore left by the roughing reamer and the blades remove about 0.005 in. of metal, leaving a true and nicely finished surface. The device is said to provide a very simple means of reboring worn or scored gas engine cylinders.

The tools are made in the form of shell reamers, and shanks can be furnished with either Nos. 3 or 4 Morse tapers.

Erratum

In the description of changes in Brown & Sharpe small tools in our issue of June 23 the following typographical error appeared in connection with vernier calipers Nos. 570 and 571: "The readings are direct, that is, there are *two* deductions to be made for thickness of the jaws as formerly." This sentence should have read: The readings are direct, that is, there are *no* deductions to be made for thickness of the jaws as formerly.



NEWS SECTION

Combination of Hill Interests at Cincinnati

The John Hill Foundry and Supply Co. and the Hill & Griffith Co. of Cincinnati, will consolidate this month under the name of Hill & Griffith Co. John Hill, one of the founders of the old Hill & Griffith Co., will be president and general manager, and William Oberhelman will be vice-president and general manager of the southern district with headquarters at Birmingham, Ala. John Hill is one of the pioneer manufacturers of foundry supplies and has had wide experience among foundrymen of the United States and Canada. Oberhelman has been connected with the Hill & Griffith Co. for twenty-one years. Bruce Hill, who will be sales manager, has represented the company in a sales capacity in several states. The other officers include L. J. Pfeiffer, treasurer, and D. N. Hill, secretary. Elmer R. Ritter, president and works manager, and Percy L. Ritter, general manager of the old Hill & Griffith Co. have disposed of their interests and have retired from the business. By the consolidation of these two companies many economies will be effected and the trade will be served to better advantage, officials claim. A complete line of foundry facings, partings, core compounds of iron, steel and brass foundries will be continued to be manufactured as well as supplies and equipment for the general use in casting plants.

New Machinery Combination Working Overtime

The recent combination of the interests of the Mayhew Steel Products Inc., of New York, and the Ready-Tool Co., of Bridgeport, Conn., are reported working not only full time on the day-shift, but to have added a night force in the factory at Shelburne Falls, Mass.

The expansion reamers which have been manufactured by the Mayhew Company as its main product, are also being made at the Ready-Tool plant.

No change in the executive personnel was made by the merger of the two companies. Officers of the combination are: President, J. W. Thurber; vice-president, J. B. Parsons; treasurer, H. W. Hatch, and secretary, L. S. Brown The only addition to the staff is H. C. Cady, who was recently appointed sales manager.

A. S. M. E. Delegates to Engineering Council

The American Society of Mechanical Engineers has nominated nine representatives to serve on the Executive Board of the American Engineering Council. The nominees, who will be formally elected by mail ballot, are: Francis Blossom, of the firm of Sanderson & Porter, New York; Charles A. Booth of Buffalo; Gano Dunn, president of the J. G. White Co., New York; H. H. Esselstyn of Detroit; W. S. Lee, Charlotte, N. C.; Irving E. Moultrop of Boston; John A. Stevens, Lowell, Mass.; A. E. Walden, Baltimore, and Perley F. Walker of Lawrence, Kansas.

The American Society of Mechanical Engineers is the first organization to submit the choice of its Federated American Engineering Societies' delegates to a vote of its member society.

American Engineers Get British Honors

With the presentation of the John Fritz Medal to Eugene Schneider, head of the famous Creusot Works, in Paris on July 8, by a mission of American engineers, came cable advices from London to the national headquarters of the American Society of Mechanical Engineers in New York announcing that more foreign honors had been conferred upon Americans distinguished in the engineering profession.

The cable message, addressed to Secretary Calvin W. Rice, stated that Ambrose Swasey of Cleveland, sponser of the Engineering Foundation and past president of the American Society of Mechanical Engineers, had been elected to honorary membership in the British Institution of Mechanical Engineers, in the British Institution of Mining and Metallurgy and in the British Institution of Mining Engineers.

Charles F. Rand, of New York, it was stated, had been elected an honorary member of the Institution of Mining and Metallurgy, and of the Institution of Mining Engineers. Mr. Rand, who is chairman of the executive board of the Engineering Foundation, has just been made an honorary member of the British Iron and Steel Institute.

Other elections announced by cable were those of Col. Arthur S. Dwight, of New York, and William Kelly, of Vulcan, Mich., to honorary membership in the Institution of Mining Engineers. This group of honors is believed to be without precedent in engineering and was described by Mr. Rice, who has been active in promoting closer relations between American and British engineers, as an important step in bringing about world solidarity in the engineering profession. A movement, it was said, has been started in the direction of federating the engineering societies of the British Empire according to the general plan adopted by Herbert Hoover and his associates in organizing the Federated American Engineering Societies, in which are gradually coalescing the national and local engineering organizations of the United States.

The ceremonies in Paris, participated in by a special deputation of thirteen American engineers under the general chairmanship of Mr. Swasey, followed similar ceremonies in London on June 29, when the John Fritz Medal for distinction in applied science was presented to Sir Herbert Hadfield, known for his work in the development of manganese steel. The Hadfield award was for 1921 and the Schneider award for 1922. M. Schneider received the gold medal in person for his achievements during the war "in the industrial and scientific defense of civilization."

Mr. Rand, it was said, becomes one of five honorary members of the Iron and Steel Institute, the others being the Prince of Wales, King Albert of Belgium, and Dr. Richard Akerman and Baron Gustaf Tamm, of Stockholm.

Germany Returning Polish Machinery

According to Kurjer Warszawski, Germany is gradually returning to Poland the property taken by the German armies of occupation. During the first half of March, 1921, there was transported, of this property, the first carload of transmission belting and the first carload of machinery destined for Lodz. The second carload of machinery and the Poznanski turbo-generator formerly in Lodz will be returned later.

New Superintendent of Babcock & Wilcox Co.

Isaac Harter has been appoined general superintendent of the Babcock & Wilcox Co., of New York, succeeding the late James P. Sneddon.

Mr. Harter was born in Mansfield, Ohio, in 1880 and was educated at the University of Pennsylvania. Immediately upon graduation he entered the employ of The Aultman & Taylor Machinery Co.. He began at the bottom in the boiler department as a gang boss on inventories, and was transferred later to the cost department, where he became familiar with the details of each branch of the business. He was elected a director of the company while in this department, and a little later was appointed acting superintendent of the boiler department. In September, 1905, the company sold its boiler business to the Stirling Co., and Mr. Harter joined the staff of E. R. Stettinius, the business head of the latter company, which was absorbed by the Babcock & Wilcox Co. in 1907. When L. I. Summers resigned the position of superintendent of the Stirling works at Barberton, Mr. Harter succeeded him, and in 1911 became superintendent of the Bayonne works. He served in this capacity until about a year ago, when he became assistant to the president, at New York, where his office will remain as general superintendent.

Tower to Aid Hoover in Dept. of Commerce

W. S. Tower, former director of the division of planning and statistics of the Shipping Board, has been appointed by Secretary Hoover as chief of the iron and steel industrial division of the Department of Commerce. The appointment was made under the export industries appropriation of $250,000, available by act of Congress July 1.

Preliminary to assuming his job as chief of the division, Mr. Tower will make a study of the American shipping problems in conjunction with the Shipping Board. He will go into the question of establishment of trade routes, allocation of ships, and assignment of tonnage. He is recognized as an authority on shipping questions. He comes to the Department of Commerce from the Consolidated Steel Corporation of New York.

The reorganization and development of trade generally will be given consideration by Mr. Tower, who is particularly qualified for this work by reason of his long and intimate association with this industry and his knowledge of the commercial possibilities of our steel business.

War Department to Encourage Military Patents

Announcement is made that it is the policy of the War Department to encourage the development of military inventions by officers, enlisted men and civilian employees. In consideration of assistance to be given by the department in the issue of patents, it will require of inventors no more than a license to manufacture and use their inventions for governmental purposes, thereby reserving to the patentee complete freedom and ownership of the patent in its commercial application. In special cases of inventions of great military importance, however, provision is made for exclusive Goverment ownership and the utmost secrecy.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

(Copyright, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

A. G. Gardiner, a leading English Liberal, has just published a book called "The Anglo-American Future" that has attracted no little attention in America. It contains two chapters that are especially germane to the week's developments. In one the author pleads for a settlement of the Anglo-Irish question in the interest of Anglo-American harmony upon the ground that the Irish question is an American question because "the Irish are in the United States as a result of an English policy that depopulated Ireland in the last century and sent a nation with bitterness in its heart across the seas."

The other, in which an Anglo-American agreement that will limit naval construction is urged, concludes with this passage: "The announcement that the Anglo-American peoples had taken a step which would make naval war henceforth impossible would strike a death-blow to competitive armaments generally, stabilize the world on a peace basis, and turn its face confidently to the light. There will be no menace to any people, but the assurance to all that in the peace of the English-speaking nations is the enduring guarantee of the peace of the world."

I quote these two passages because it is doubtful whether the business men on either side the Atlantic have as yet commenced to sense the importance of the conference between Lloyd George and Valera now being held in London or the disarmament conference called for next autumn by President Harding. The details of both these history making meetings are fully described in the newspapers. They need not be repeated here.

If, as every one must hope, the results shall be permanent tranquility in Ireland and a compact between England and America that will insure the world against war, the debts with which society is now burdened can soon be repaid and the return of prosperity will be greatly hastened.

Even the dull markets of mid-summer seem to show a subconscious appreciation of the reconstructive statesmanship that is now in the ascendant. The fear that a bonus bill might make a new bond issue necessary has been temporarily allayed by the President's outspoken opposition to the measure and business is becoming almost normal as the crops approach maturity.

There are, however, two industries that are exceptions to this statement. In both the hope of lower prices restrains present buying. One is the steel industry. The other is coal. In so far as steel is concerned procrastination is unlikely to do much harm. The manufacturers are used to extremes of activity and dullness and can adjust their affairs accordingly.

But the winter shortage of coal that is to be expected unless consumers soon commence buying is not to be so complacently contemplated. Last autumn when the country was almost panicky in its fear of a winter coal famine and people were being stampeded into paying outrageous prices, I repeatedly pointed out in these letters that there would be enough coal to go round. But this year the position is different. We entered the spring with comparatively light stocks, the production of bituminous and anthracite since January 1 is 62 million tons behind last year and if the winter should be severe and industrial activity revive as is likely there may be a fuel shortage that will cause great distress and loss. Making due allowance for high freights and labor soft coal is now relatively low and those who would be wise in time will in my judgment do well to hive a substantial portion of their requirements at once.

As to a revival of business it may be said that it has already commenced in the textile markets. In six out of seven large cotton commission concerns visited this week I was told that the demand for immediate delivery was in excess of the supply and that there was a very noticeable increase in buying for export to East India and China. This, as was pointed out last week, is in part due to the Government Report on the cotton acreage which indicates that the South has at last learned to co-operate in controlling the size of the crop but it also reflects the world wide shortage of cotton goods that has resulted from under production in Europe during the war and since.

Cables from Liverpool and Manchester are almost unanimous in predicting sustained activity in the Lancashire cotton trade now that the coal strike is ended and the operatives have accepted a reduction in wages.

But the textile trade is not the only one from which quickened activity is reported. The shoe industry is picking up, and the Endicott Johnson Co. is operating at full capacity to fill orders that are said to be 25 to 50 per cent above those of the corresponding period last year. Briefly, there is a steady though "hand to mouth" demand for all essentials that are cheap except coal, but there is no anticipatory buying as yet and stocks must be low everywhere.

Reports to the Credit Clearing House indicate a reduction of only 4½ per cent in the money value of the merchandise sold during the week ending July 15, and bank clearings for the same week as compiled by Bradstreet are but 26 4 per cent under last year. These figures, as I have so often pointed out, mean that more goods are changing hands and while the profits made are not as large as in the extravagant days of the war it is plain that there is no lack of business. A corporate report that is interestingly corroborative of this view is that of the American Telephone and Telegraph Co. in which it is announced that 285,000 new telephones were installed during the last six months and that the telephone traffic of the system for that period was larger than in 1920 despite the slowing up in general business. On the other hand it is to be noted that the buyers' strike still continues where prices have not been reduced and that it is now extending itself even to such indispensables as ice cream soda, as witness the self denial of the children and mothers in the Bronx and Brooklyn in refusing any longer to pay more than five or ten cents a glass for what has become almost a staple form of food and drink in this country. As I am informed that the expenditure at the soda fountains in the United States last year was $500,000,000, which is about the present value of the growing cotton crop, it is plain that a 50 per cent cut in the cost of sodas and sundaes has greater economic importance than might generally be supposed.

The railroads are doing better. Car loadings for the week ended July 2 were 774,808. This, while not as large as last year when business felt the stimulus of the spring boom, is in excess of the more normal traffic of 1919, and earnings, both gross and net, are now larger than in either year. It is not, however, to be expected that the roads will admit prosperity until they get all that they can from the Government and there seems to be every reason to expect that they will obtain at least $500,000,000 in new cash shortly. Meantime railway stocks are steady and bonds are gradually working higher as a result of the growing ease of money as well as of the improved condition of the transportation industry.

Except for the gyrations of Mexican petroleum and a fairly steady demand for the "rails" the stock market has been in the doldrums. The bears have ceased to attack it but the hot weather has checked the development of any speculative enthusiasm.

The weekly statement of the Federal Reserve Banks shows an increase of 1.6 per cent in the reserve ratio, which now stands at 61.6 per cent and a further gain of $15,000,000 in the gold on hand. It is said that some of the gold recently arriving in New York has been put "out of sight" lest its continued accumulation in the Federal Reserve Banks might have an "inflationary effect."

Merchandise exports and imports for June compare as follows with the previous month and last year:

	June, 1921	May, 1921	June, 1920
Exports.....	$340,000,000	$330,000,000	$631,082,648
Imports.....	198,000,000	208 000 000	552,875,088
Excess exports...	$142 000 000	$122,000 000	$78,207,560

The excess of imports for the fiscal year ending June 30 is $2,852,596,000 as compared with $2,872,418,000 in 1920 and $4,136,562,000 in 1919, which was a record. For the seven years ending June 30, 1921 value of our merchandise exports exceeded that of imports by a total of $19,693,000,000, or an average of $2,817,000,000 annually as compared with a pre-war average of about $500,000,000.

We must be prepared for a return to the pre-war average if the Fordney Tariff Bill passes, for we cannot expect to sell if we refuse to buy. Meantime, and pending the passage of the bill, importers will naturally try to bring in all they can in an effort to escape the higher duties imposed. The decline in foreign exchange registered during the week will also operate as a stimulant to imports.

The cause of this decline is a mystery. The speculation in foreign exchange is enormous. 50,000,000 marks were bought and sold in New York in one day last week and the trade at London, Paris, Berlin and Frankfort is probably quite as large. It is preeminently the gamble of the war and the influences that affect values are complex beyond the grasp of even the best informed. Whether and why sterling and the various continental currencies should go up or down in the future no one can pretend to know and the safest course is to avoid the risk of a problem so inscrutable.

The tariff debate is fully reported in the daily press. The President's opposition to the duty on petroleum has been disclosed and the Mexican oil companies are thereby somewhat reassured. Opposition to the valuation clause of the Fordney Bill seems to be increasing. Money is in good supply in New York but 6 per cent for the best commercial paper remains the minimum here and higher rates prevail in the West and South.

The Cuban crisis is still unrelieved though there is much talk of a large American loan to carry over the surplus supply of sugar.

From Mexico there is no authoritative news. The best opinion is that Obregon is so fully employed in putting his own back yard in order that he cannot pay much attention to externals.

Our trade with Latin America is, however, so small in comparison with our domestic commerce and finance that it takes a subordinate place in the public mind which is gradually becoming more cheerful and would be almost optimistic were it not for the unconscionable delay of Congress in dealing with the oppressive taxation that makes capital inert and timid.

Cincinnati to Produce Gas Conserver

Cincinnati has gained a new industry in the formation of the V. & P. Vacuum Co., which has been organized to manufacture and distribute a purely mechanical attachment—known as the V. & P. Vacuum system—for the motors of automobiles. This device is said to be a gas conserver, to reduce the gasoline consumption by the motor and increasing the mileage obtainable on a gallon of gasoline. And is also said to prolong the life of the lubricating oil as much as fourfold.

The company, which is chartered under Ohio laws, is capitalized at $25,000 at the start. Its principal offices will be in Cincinnati. The company organized by electing Frank J. Zumstein, president; A. C. Van Kirk, vice-president, and William Pope Anderson, secretary and treasurer.

These officials, with George A. Sawyer, H. M. Potter, and Attorney Joseph Sagmeister, all of Cincinnati form the directorate.

Free Rent!

Antrim Iron Co., Mancelona, Mich., which closed down for the summer, has given free rental of its houses to employees while the plant remains idle, the only condition being that the men agree to return to their jobs when the company resumes operations.

Business Conditions in Germany

BY OUR BERLIN CORRESPONDENT

The various schemes hatched in the government for enabling it to pay the 50,000,000,000 marks, which is the annual reparations for several years to come, are now gradually becoming visible in their outlines, much to the alarm of the industry. A number of radical measures are contemplated, which must inevitably lead to a further increase of the cost of living. Such measures are the mortgaging of all real estate in cities and in the country for raising a large capital. Neither agriculture and in a far lesser degree the owner of city real estate, could pay the interest on such mortgages under the present rate of revenue. The whole conglomerate of measures for artificially keeping down rent and the price of certain foodstuffs must necessarily collapse. Rents would go up to a multiple of the present standard, and the price of foodstuffs must clearly follow suit, ultimately arriving at the world market level. This trend of affairs, which at first was only surmised with keen apprehension, is now frankly confirmed by the highest authority, the German Minister of Economy, who clearly expressed himself that the government's policy of keeping the cost of living in Germany below the world market level would have to cease. The consequence would, of course, be the immediate increase of wages and salaries in leaps and bounds up to the foreign standard. The chief advantage which the German industry enjoyed over foreign rivals would thus disappear completely. It is even probable that the upward movement would surpass the boundaries represented by the cost of living in the surrounding countries, and that Germany, from being one of the cheapest countries of Europe, with the lowest wages viewed from the basis of gold currency, would become one of the most expensive. Apart from that, another incisive measure projected by the government is threatening the industry. Similarly to obtaining a share in the real estate of the country, the government is endeavoring to get a share in all industrial property. If these measures are finally adopted, they would put the industry in a position the consequences of which cannot yet be foreseen by anyone. It would probably mean the end of all business which solely existed on the strength of cheap labor, and would practically amount to a fresh start from the bottom rung under entirely new and unlooked-for conditions. The industry would not even retain the advantage of cheaper raw material, as the prices of the latter would in conjunction with the universal upward movement of prices naturally get flush with those in other countries of Europe. It has already been announced by the government that the coal tax would be raised to such an extent that the difference in price between German and foreign coal would disappear. Moreover the state is contemplating a number of monopolies on the distribution of raw materials, which, handled with fiscal considerations foremost, would surely not reduce their price.

Needless to say, the government, when trying to introduce such schemes, would find a strong opposition against them. Whether it will succeed in carrying them out in their entirety will be seen in the near future. It is probable that it will have to pour some water into them, and serve them in doses, but it seems inevitable that the country will have to traverse a steep up-hill road. The most critical times of the German industry are apparently not past, but still ahead.

Conventions Well Attended

The present season is the time for annual conventions, which are usually held in May and June. At no previous time, however, have they been chasing each other in such bewildering numbers as now, and are attended by audiences as numerous as at the present time. The conventions are significant for the willing spirit and intended desire for co-operation, which has developed so far that it has become a serious danger to individualism. While the repertory of such conventions is chiefly filled with paper dealing with engineering progress, private discussions are monopolized by the present business and the outlook. The annual convention of the German machine building industry, which has just taken place, has not even made a pretense of treating technical subjects, but has solely devoted itself to economical matters. During the war, and in the after-war years, this society has from a rather insignificant organization grown to an institution which now represents almost the whole machine building industry and allied branches. In 1914 it had 250 individual members employing only 180,000 men, which number since then has increased to nearly 1,000 members, employing 550,000 workers. Besides it includes more than 100 other societies of various branches of the machine building industry, representing roughly 2,500 factories.

The official proceedings of the convention were chiefly devoted to the inner organization of the society. Of interest is the resolution passed to continue the control of export prices, for the significant reason that its removal would inevitably lead to price cutting. The effects of the sanctions, especially the customs barrier in the Rhineland, were extensively dwelt upon, and the opinion was voiced that the continuation of the sanctions would result in paralyzing business between the Rhineland and the interior of Germany.

The German Association of Machine Tool Builders has now issued its report on the year 1920 in advance of the annual meeting, which will be shortly forthcoming. This report is clad in the form of a communication to the members, and considerably falls short of the reports issued in previous years, in length as well as in substance. It is, however, full of complaints on the business situation in general, and reflects rather gloomy views. According to the report, the situation of the industry has in 1920 hardly improved. The after effects, so the report says, of the enormous increase of production required by the war were felt more and more.

Machinery from numerous shut-down works, or such sifted out by the readjustment to peace work, has been pressing heavily on the market. The increase of stock in most machine-tool building factories, it is said, justifies the opinion that the industry has got into a state of overproduction. After dealing with the general business depression, which the report attributes to the increase of prices, and the decrease of purchasing power, it is declared that the industry has reached a very critical stage. If hopes were entertained that the experienced owners and managers of the machine tool factories would be able to find a way out of the present crisis, it can now be said that not all have succeeded. This is the expression the report finds for the fact that in the course of time a number of machine-tool factories have got more or less into distress, of which manifest signs have become noticeable of late. The Association of German Machine Tool Builders has again expanded as regards number of members as well as to organization. In the former respect it can be said, however, that it has reached its culmination. There are numerous manufacturers who have deliberately stayed away from the association in pre-war times, and who have only joined during the war because the association has, owing to public functions which it has been given during the war, assumed an authority which no manufacturer could easily afford to ignore. The return to normal conditions has deprived the association of these functions, and it seems that the spirit of independence amongst the members is again rising, although no actual exodus of members has taken place as yet. A number of members are, however, contemplating to leave the association at the first appropriate opportunity.

The hotbed of dissent is evidently to be found in the committees which have been formed with a view to close co-operation and a uniform price policy between manufacturers of kindred types of machinery. These committees, which at first were hailed as a great achievement, are showing signs of decay. As long as business was brisk, and co-operation seemed instrumental to obtaining the best possible prices, the committees were considered excellent institutions, but in the present time of depression they have lost favor. The main task of the committees is to prevent price cutting by stipulating standard prices. This is very well for the factories enjoying high reputation, but it is turning business away from the others, who are unable to balance lesser reputation by more attractive prices. The number of truants from the rigid rules the committees have established is therefore growing, and co-operation in the committees has considerably relaxed.

Another reason for the tendency to disperse in the association is its enormously enlarged organization, involving it in heavy expenditure. The association now occupies extensive premises, and has nearly a hundred employees. The maintenance of such an organization is no small item for the 392 members, although a number of other organizations—like the society of makers of wood-working machinery, of grinding material, small tools and twist drills—take part in the expenditure. The share falling to the single manufacturer is, however, large enough not to be borne without remonstrance, unless for good reasons. Apart from that, an organization of such size can be trusted to perform a large volume of clerical work, which among manufacturers is felt more and more in the nature of a bother. Moreover, the chief enterprise of the association, which also is a very expensive one, the exhibition of machine tools at the Leipzig Fair, is now more and more recognized as a failure. The report of the association tries to disarm criticism by throwing the blame on the particular mischance by which this exhibition has up to now been prosecuted. It also gives to understand that no actual sales can be expected from such exhibitions, but that they must be regarded as an advertising scheme. The report is, however, compelled to admit that the association has become rather doubtful whether to make the Leipzig Fair a permanent institution, or to abandon it.

Lack of Co-operation

There can be no doubt that the increased importance the association assumed during the war and in the turbulent years immediately following is now decidedly on the wane. The work of the association is too onesided, too much centered on the price policy. Other most urgent requirements have been neglected or overlooked. Most factories have during the last five or six years extended their manufacturing programme, as it is called in Germany, meaning the number of lines carried, thus increasing competition. In spite of the common cry for specialization, the industry has turned away from it rather than made progress towards it. A retrograde movement seems imperative. The association has done nothing to exercise an influence in this respect. In most essential details, co-operation, even advice, as to over- or underproduced lines, of which the association from its high point of observation which it has attained would be quite capable, has been lacking altogether. Otherwise it would not have been possible that in numerous instances the same type of machinery has been adopted simultaneously by several manufacturers, an instance of which is the Gridley automatic, now manufactured by no less than seven German firms. It is therefore no surprise that manufacturers are looking for other and more effective means of co-operation and cutting down of competition through agreements or business combines between themselves.

Several Mergers

The movement towards combines and merging, which has seized so many branches of the German industry, has up to now been peculiarly absent in the machine-tool industry. It is true that a number of firms have been welded together, but this was done by purchase from outside, like in the case of the works acquired by the large concern of iron dealers, Otto Wolff in Cologne, which first bought the Defries works in Düsseldorf, and amalgamated the latter with the Klingelhöffer works, to which have thereafter been added a number of smaller firms. Another group of this kind has been formed by a firm of second-hand machine tool-dealers, which in the obscurity in which it existed before and during the war has amassed a large fortune, and has now bought up a number of machine-tool factories. Combines of machine-tool manufacturers among themselves have so far been rather scarce, but a few instances of the last months show a growing tendency in this direction. One of these instances is the combine between two large Chemnitz machine tool-works, the Union and Sondermann & Stier. These two firms have up to now been keen competitors in almost all lines. By an agreement which will probably lead to amalgamation they have divided ther manufacturing lines between themselves, in conjunction with the factory of Carl Wetzel in Gera. Sondermann & Stier is giving up the construction of horizontal boring and turning mills in favor of the Gera firm, which is specializing in

such machinery, and by the way is making a very good copy of the Lucas machine. A similar agreement has previously been arrived at between this firm and the Union Company.

Other cases of a similar kind are expected to follow. The tendency in all such cases is to eliminate or cut down side lines with a view of getting some recompensation for the business abandoned, in preference to giving them up entirely.

Business "Picking Up"

During the last weeks a marked improvement of business has taken place, not only in inquiries coming forth again in fair numbers from domestic sources and from abroad, but an increasing amount of orders has actually been placed. A more hopeful outlook prevails with regard to export business. Many negotiations for machinery which were started several months ago, and were dropped at the time of the London conference, have been taken up again, and new inquiries have come in. The Scandinavian countries, mainly Sweden, which had almost withdrawn from the market, are again showing increasing interest in German machinery. A slight revival has also taken place in the business with Belgium, France and England. In the latter country German machine tools are still barred, but it is an open secret that they are sold under foreign flag, at least in small quantities. Rumors have spread of large sales of German machine tools made in the United States, but although it is true that some sales have been effected of types which already had a market there in pre-war times, like Reineker's backing-off lathes, Henry Pels' punches and presses, and Pfauter gear-hobbing machines, the volume of business actually transacted is negligible. Such rumors have evidently been caused by numerous inquiries from American dealers for German machinery, promising large orders. Manufacturers are skeptical, believing that such inquiries are prompted more by curiosity than by serious business intentions. It can not at present be seen whether the revival of business is any more than a backflow after the standstill of the last two months, or whether it signifies a turning of the tide. The coming months will no doubt clear up this point, which is awaited everywhere with keen anxiety.

Comment on the Machine-Tool Business in France

By Birger Erichson

Since the war started we have had a succession of "crises" of various kinds ranging all the way from a spaghetti "crise" to a copper coin "crise." Today, however, they all seem to have joined hands to form one grand "super crise," which has taken into its stranglehold all branches of industry and business to an extent where nobody buys anything.

And the machine tool business has followed in the track of its fellow businesses, and gone and left its many followers with plenty of spare time on their hands, and even the "second hand" business, for a long time the only prosperous branch of the machinery trade, has dwindled to proportions where its many enthusiastic friends become faithless to the cause and go hunt for other things to sell.

Due to the fact that the French government is accused of killing the goose with the golden eggs in fixing price of gasoline at $2.50 a liter or somewhere around 80 cents a gallon, nobody but the "nouveau riche" can ride in autos any more. A serious "crise" in the automobile field has been the consequence. Everybody knows what a fine lot of machine tools the automobile factories bought during the war, in fact they have been accused together with most of the other industries the world over, of putting their profits into "bricks and machinery" instead of into the cash box of the country. Now a considerable quantity of these tools are for sale and there is hardly a shop in the country that is not willing to part with some of its equipment for cold cash, even if this consists of dirty paper money with not much backbone to speak of.

Exactly how much equipment there is available is practically impossible for anybody to say, but that there is enough to last for the next few years, even if a general pickup of business takes place this fall, is clear to anybody who is going around today to the shops in this country.

Surely the North of France when the time comes that we have reached the bottom of the curve and start climbing skywards, and when some of the German indemnity billions have found their way across the border, will want quite a quantity of machine tools, but they will in all probability almost entirely be found right here in this country or bought from neighboring countries with favorable exchange rates. There are rumors about at present that the French government will take one billion francs worth of machinery and tools as part payment of the indemnities due from Germany to be distributed among the devastated factories in the North. These rumors are not yet officially confirmed but it is very probable that the same system will be used for machinery as for the housing question, where actually 25,000 wooden houses are to be delivered. Naturally this whole billion will not be in machine tools only, but in all kinds of equipment such as compressors, pumps, etc. If, however, only one-half or 500,000,000 francs, should be in machine tools this would mean no import of American machines to supply the devasated regions.

German Competition

Quite a quantity of German tools were bought by shops in the North last winter and spring. Naturally at present German competition does not make itself felt at all simply because a difference in price, however big, will not induce a customer to pass an order. When business comes back to life however, the German competition will again be strongly felt, as no Frenchman, however patriotic and "boche" hating, will pay twice the price to avoid buying stuff made in Germany, barring political complications or that the dollar exchange should suddenly decide to take steps toward helping the lame and wounded French franc back on the road to prosperity.

To give the readers some idea of the prices that American machine tools can be bought at today in France I shall cite a few examples: A Gisholt tool grinder overhauled and to all practical purposes as good as new can be had for the equivalent of less than $200 delivered to the customers works. I doubt that our friends in Madison even with their truly highly efficient organization can deliver their machines in France at that price. Or a Warner & Swasey fully-tooled, brand new 3-A hollow hexagon turret lathe for the equivalent of less than $2,600. And there are hundreds, if not thousands, of similar cases.

And if the exchange should go down and the American manufacturers be able to reduce their prices still more, the prices hat the possessors demand here will follow down. For mind you that the selling prices today are based on the present value of the dollar, whereas the machines offered were mostly bought at a rate of six or seven francs to the dollar. Consequently the machines can in case of necessity be sold at about one-half to two-thirds of the present price without causing a loss to the owners.

And on top of all this France is turning out a respectable lot of first rate machine tools. They are somewhat behind in the more difficult types of machines such as grinders, boring bills and milling machines, but lathes, planers, drills, radials, etc., are fully up to the better class. A Swiss firm is putting on the market a milling machine of a new design, that will surely prove a success.

American Salesmanship

The American machine tools have before and during the war gained a market in Europe, and the problem today is not to work in on a new market but to keep an old market under extremely adverse circumstances.

With all due respect to American business men and methods, the successful salesman in America is not always a success in Europe, more so as the young American sent over by his firm in the States mostly considers his stay in Europe as some kind of a vacation and with the idea of remaining only a short time before his return to America. Ways and means of business are widely different here and it takes a man with thorough knowledge of the field to make a success. Especially is a thorough knowledge of the language necessary for the men trying to maintain the old reputation of the American machine tools and their manufacturers on this side.

As far as the financial part is concerned, the sooner the American manufacturer forgets the eternal "cash against inland bill of lading" the better for his export business. Let us hope that the movement now under way in the United Staes for furthering and financing foreign trade will soon bear fruit.

And the packing!. Much ink has been flowing in this battle, but the importance of proper boxing has seemingly not yet reached all concerned. The writer received a few weeks ago some American machines packed in cases, that anybody might indeed be proud to own in his home as bookcases, or that might make a beautiful home for some poor devil. Unfortunately the packer had not thought of fixing the machines properly inside his beautiful boxes, and as the cases were incidentally about 4 times bigger than the machines, these had been rolling around inside, rocked by the Atlantic swell and knocked about by the gentle longshoremen and railroad employees. When after several days' work we managed to pry the boxes open we found inside the remainder of what had once been perfectly nice milling machines. And no insurance company will listen to a claim for damages under these circumstances.

Peculiar Needs

The needs for certain types of machines are different in the various countries. For instance here in France nine out of ten customers when they want a lathe ask for a gap lathe. This is due to the fact that with a few exceptions the industries are not producing "in serie" as in America where machines are bought for and employed on the same job continuously. Here a lathe has to be prepared to take on any kind of a job at short notice, consequently a gap bed is the thing in demand. This question of supplying what the customer wants and not what you think he ought to want has been the proverbial success of the Germans, and considerable of a stumbling stone for the American manufacturers and American salesmen in France.

Automobile and Tractor Market in Algeria

An interesting report on economic conditions, with special reference to the automobile industry, by Consul Edward A. Dow, Algiers, contains the following information:

Algeria has excellent vehicle roads and more than 10,000 automobiles, the larger part of which are French cars, owing to preference for the products of the mother country, absence of customs duties, and nearness to the French market.

A few American cars have been sold with the advantage of low price, and but for the unfavorable rate of exchange would find a good market. An American truck of about 7 tons should under normal conditions find a good sale in Algeria. Since the war most transactions are on a cash basis. Nearly all the gasoline is imported from the United States. Motor vehicles are in common use between coast cities and also between mountain and desert settlements, competing favorably with train service both as to time and cost.

For the five years ended September, 1920, Algeria imported 525 tractors, of which 450 were American. Recent crop failure has prevented this rate being kept up, but a good crop is expected this year; and should there be an improvement in the exchange rate, a good opportunity would be found again for American tractors.

Western Editor of "American Machinist" Takes Up New Work

J. V. Hunter, Western editor of the *American Machinist* for the past several years, recently resigned to become editor of *Motor Service* a new magazine being launched in Chicago with headquarters in Machinery Hall.

English Machinery Combination in Argentina

Several British machinery manufacturers have recently combined in opening a general sales office in Buenos Aires. Unity and concentration are the key words of the combine. The "Review" of the River Plate in commenting on the opening of the office states that "its inauguration here proves that the British manufacturers intend to make a big bid for Latin-American trade in these lines which have been largely in the hands of German and American competitors."

A number of prominent manufacturers' representatives and American business men in Argentina have suggested the idea to American manufacturers not only for machinery but for hardware, textiles, and other items. Such a combination could be promoted in a manufacturing association, offices of this type could be opened in various foreign centers, especially those where competition is strongest and the advantage obtaining from concentration, closer application, centralization, and well directed advertising and propaganda would doubly repay for the initial trouble and expense.

Hoover Decries Pessimism

Secretary of Commerce Says We Must Help Raise Standard of Living in Europe—So Doing Will Help Our Own Recovery from the Effects of the War

We print herewith in full the address of Herbert Hoover before the National Shoe and Leather Exposition and Style Show (Inc.), at Boston, Mass., on Tuesday, July 12.

"There is a feeling of some uneasiness and even of pessimism regarding the future of our foreign trade, in which I do not participate.

"Our exports and imports during the last few months have dropped nearly 50 per cent in value from the high-water mark of a year ago. Some of this decrease is due to the fall in prices relatively more than volume; some of it to the temporary world depression, and some of it lies deeper.

"In these times of troubled minds we find much conflict of opinion as to the situation and its remedies. Some extreme groups insist that inasmuch as our exports comprise but 10 per cent of our total production, therefore our foreign trade bears only this ratio to our economic life, and that consequently our true course is to forget it and to devote ourselves to healing our internal economic wounds. Other extreme groups consider that for our internal situation the only remedy is restoration of our export trade and they would undertake desperate measures to accomplish it. In either case we must not allow the present extreme industrial depression to obscure our view. We have passed through several depressions since the Civil War and we have already turned the corner of this one.

"The importance of our foreign trade requires but little defense. I may say in passing that our whole standard of living greatly depends upon our imports and that our exports are the great balance wheel for our production. Exports are vital to the stabilization of our industries, of price levels, of wages, and of employment. While our exports do cover but a small per cent of our total production, on the other hand they do comprise a large percentage of the production of certain industries. For instance, we generally export 20 per cent of our wheat, 60 per cent of our cotton, 75 per cent of our copper, not to mention others. Unless we find a market for the surplus production of our great industries, we shall continue to keep some 25 millions of our people in reduced buying power. We might even drive them into poverty—during the many years that would be required to shift the whole basis of our internal production. Nor does a nation become rich by its exports alone—but by its trade.

"While many of the causes of the present depression lie within our own borders, yet there may be no recovery from these hard times for many years to come, if we neglect our economic relations abroad. Even if we lower our vision of civilization in this crisis solely to our own selfish economic interest, we are yet mightily concerned in the recuperation of the entire world. The hard times that knock at every cottage door today came from Europe. No tariffs, no embargoes, no navies, no armies can ever defend us from these invasions. Our sole defense is the prosperity of our neighbors and our own commercial skill. The recovery of our foreign trade can march only in company with the welfare and prosperity of our customers.

"When we analyze the present foreign trade situation, we find tremendous shifts in economic currents since 1914. Indeed, we find great changes still in progress. If we would guide our policies of production and trade aright, we must keep these great changes constantly in mind. These profound alterations naturally fall into two divisions: The shift in the world's production and markets and the shift in the world's financial relations. They bear upon each other, and they affect our three primary groups of food, raw material, and manufactured goods differently.

World Changes in Production and Markets

"There have been great changes in our own economic situation. We have not alone shifted from a debtor to a creditor nation. Our capacity for surplus production in food and manufactures has grown enormously during the war until we have taken front rank of the world in foreign trade.

"The direction of our trade has shifted greatly. During the last year about one-half of our whole foreign trade was with Europe, but of our exports to them 80 per cent were foodstuffs and raw material; of our exports to states outside of Europe about 75 per cent were manufactured goods. Europe in turn is our serious competitor in marketing of our manufactured goods to the rest of the world. We have enormously increased our imports of tropical and other commodities that we do not produce.

"Since the World War began, the world outside the fighting states of Europe has gained mightily in wealth, in standards of living, and in consuming power. Even omitting the United States, it has gained something like *forty* millions in population. The countries not directly affected by the war are indeed suffering from the general depression, but this depression with them is only the aftermath of the malevolent forces born of the past war booms. They have none of the deep economic wounds of the fighting states, and they will be quick to recover. During the war the productive capacity of these states, except possibly Japan, had no unusual increase because of their isolation through shortage of shipping.

"One of the economic shifts that affects the whole world profoundly is from Russia. Russia bore much the same relation to western Europe before the war that the Mississippi Valley bears to our Northeastern states. Russia was one of the great food bases of the manufacturing countries of western Europe, exchanging food for their fabricated products. These manufactured goods in turn were to some degree produced from our raw materials. Even at best it will be many years before Russia will have recovered. We are today the only great source of enlarged food production. Europe must and will draw from us a great proportion of food supplies that she formerly drew from Russia. I see no basic reason why we should not continue to export approximately the same large volume of foodstuffs that we have shipped abroad during the past twelve months. This item alone at even present prices would be triple our pre-war food exports, and would represent the equal of more than 60 per cent of our whole pre-war export trade.

"Another great but uncertain shift in world forces will arise out of Germany. The reparation payments must have a profound effect upon the whole economy of the world. Germany is to pay outside her borders to the Allies $500,000,000, plus 26 per cent export duty, or, say, a minimum of about $750,000,000 per annum. Germany is left without much gold foreign property, or foreign business earnings of consequence; therefore, these payments must be made mostly by the sale of manufactured goods outside her borders. But beyond the reparation payments, she must also sell goods abroad in the amounts necessary to buy her imports of food and raw materials. Any calculation based on the pre-war trade of Germany implies an enormous increase—perhaps more than doubling—of her pre-war exports. In view of the export duty and other payments, she must produce these goods for about one-half our production cost in order to take our markets. Such an increase in exports must be manufactured goods, and until the world consumption grows, these must be marketed in displacement of the goods of other industrial nations. We shall certainly feel the effects of this flow of goods that must be produced if she is to make reparation payments. On the other hand, Germany must take more raw materials from us for this purpose. In any event, the crowding in the market of German exports will affect her immediate neighbors more than ourselves, for 80 per cent of her market, pre-war as well as in the future, must lie in Europe itself.

Other Changes Among Combatant States of Europe

"The economic changes in the other combatant states in Europe obviously affects us also. The economic wounds given to them all by the war will be a long time in healing. The sacrifice of skilled labor, of brains, and of property will require a generation to cure. The hates of many newly liberated states must cool slowly, and their many new borders check the free flow of commerce. Many of these states possess masses of people who have suffered from exploitation and tyranny for generations. Their extreme reactions of Bolshevism and socialism and nationalization are slowly dying out. Many governments have been unable to raise sufficient taxes to meet expenditures, and the ceaseless printing of currency carries destructive inflation. All of them except the enemy states bear the burden of greater military establishments than even before the war. All this must accumulate to decrease their productive power and to lower their standards of living.

"In balance against this loss of productive power, their people over great sections are now coming to a full realization that they must work harder than ever before and that they must export commodities for all that is in them, in order that they may make exchanges for the bare margin of life. They will some of them receive payments from Germany in relief of their tax burdens. They are mobilizing the skill and the intelligence of their people to their economic salvation with the same diligence that they were mobilized in war. The great manufacturing states are straining every device of science and thought to the improvement of their industrial processes, to the simplification of products, to the elimination of waste—that they shall make every reduction in production costs. In reinforcement of their marketing machinery, many of the governments are stimulating the consolidation of banks and of manufacturing concerns. Governmental and government encouraged combinations are being created to control exports and imports to exploit foreign markets. They are seeking special concessions for development and trade throughout the world. Altogether these policies comprise a militancy in commercial expansion that compared with Elizabethan England.

The Effect Upon Us

"Any improvement in European production of manufactured goods will favorably affect our market for those raw materials such as cotton and copper, where we possess the final supplies. In considering the demands for such raw materials, we must remember that the manufacturing countries of western Europe have lost for a long time to come any great markets in Russia and Turkey; the population of Europe as a whole has not the consuming capacity for manufactured goods that it had before the war and, therefore, we must expect a less than pre-war consumption in the confines of Europe for their remanufacture of our raw materials. But on the other hand, they will find after this depression is passed that the markets of the rest of the world are larger than before the war. I am confident they will gradually return to prewar demand for our cotton, copper, etc. Fortunately, our producers have realized this temporary situation and have vigorously reduced their production so that they should eventually realize better prices than at present.

"It seems to me that it was inevitable that the balance of the forces at work in Europe would improve their ability in competitive manufactured goods. Their production costs were bound to be low, both by better organized industry and by lowered standards of living. Some of them are today through government subsidies, artificially low and will undoubtedly increase. If we analyze the effect of these forces on the market for our manufactured goods, either in Europe or in our much larger market outside of Europe, we quickly find two directions in which we occupy a position of some security. The first is in those exports of lower production costs which are the result of great repetitive production, which has its firm root in our enormous consumption. The second is in that large number of special manufactures in which the inventive genius and skill of our people have been developed beyond any country in the world. Your own industry of shoes and shoe findings is typical of these two characteristics. I believe we will recover and can hold our share of the market for these products after the present world depression.

"As to our manufactures containing a large element of labor cost, in which we do not enjoy special advantages, we must look out and take measures of our own. We can no doubt devise tariff measures that will protect our domestic market. But if we are to hold to our foreign markets in this vast group of our manufactures, and thus to keep our people employed, we have several things to attend to. Fundamentally, we must get our production costs down.

That lies only along the road of increased efficiency in our whole industrial machine. It means a willingness of our working people to put forth every effort that is in them consistent with health, proper family life, and good citizenship. The surest road to a continued high wage, and the surest safeguard against unemployment is to remove every restriction on effort. This must extend from our mines to the railways, to the factories, to the wharf, and to the ship. It means smaller margins of profit. It means that ultimately we must have much lower transportation rates. It means we must have better organized marketing machinery abroad under Americans themselves. It means the establishment of adequate short time credit machinery and much more care in foreign credit risks than our merchants have shown in the last 12 months. It means elimination of the great wastes in industry. For instance, in the Atlantic seaboard area alone, by the development of these great water powers and through economies by electrification generally, we could profitably save 30,000,000 tons of coal per annum if we had the courage to go at it. It means the Government must remove as quickly as possible those unnecessary domestic burdens upon commerce to which the Government is a party, by the reorganization of our tax system, the settlement of the tariff question, the reduction in Government expenditure through the reorganization of the Federal Government, through reduction of armament and through reduction of Shipping Board losses and by the settlement by the Government of the outstanding claims of our railways. It means we must cease trying to drive American ship owners off the sea with tax-paid shipping losses. We must carefully determine what particular trade routes we will maintain in development of our commerce over a period of years, and let our merchants know them. It means the Govermnet must provide such information to commerce and industry, from both at home and abroad, as will enlarge its judgment. It means we must extend scientific research into the problems of waste, the perfection of processes, the simplification of methods that are beyond the ability of one manufacturer acting alone, and we must co-operate with industry to perfect these things. I am confident we can hold our markets, our higher standards of living and of wage if we will all put our backs into it.

The Shift in Credits

"Overriding all these questions of production and markets is one of credits. Our whole financial relation to the rest of the world has greatly shifted. From a nation owing some five billions of dollars to the rest of the world for moneys borrowed, the war has reversed our position so that the world, principally Europe, owes us today from thirteen to fifteen billions of dollars, of which about ten billions is due our Government. Before the war we had to export a surplus over our imports, and beyond this had to contribute through remittances of immigrants, tourists, shipping, etc., great sums to pay interest upon our debts.

"The reason for the piling up of this vast debt is, of course, that we have not only loaned money to the Allies but have also since the war vastly increased the surplus of our exports, and the movement still continued to accumulate in our favor. Unless we would cease a large part of our war increased productivity with all the resulting unemployment and losses of such a cessation, we must continue for some time to export in excess of our imports. Eventually the increase in our imports of tropical supplies, minerals and commodities that we do not ourselves produce, together with the spending of tourists and the investment of surplus capital abroad, etc., should overtake our export balance and establish a proper equilibrium. In the meantime, if we would maintain our economic position, we must continue to give credits to buyers of our goods and if we should demand interest or principal on our established loans we would nullify any benefits of such credits. I may repeat that if today we stop giving more credits and demand payment of interest on debts due our Government, our exports will further decline, and the decline will find its interpretation in more unemployment among our own people and more displacement of our industries.

"The natural effect of our surplus of exports (although we have as yet made no demand for payment of interest on the Government debt), is that our dollar is at a premium over even the most stable currencies in the world. Thus the cost of producing our commodities is higher than in any other country. This does not so materially affect the export of those commodities of which we hold a final supply, such as the food supplies and our raw materials, or those articles in the manufacture of which we have unique ability. It does, however, partly blockade our exports of manufactured goods in which we directly compete with Europe. Exchange itself is not the cause but the effect. It bears the same relation to trade that the barometer does to the weather. It is but an indication of the movement of commodities and credit. Our high barometer means we need more credits outward or alternative we must send less goods out or take more goods in.

"I may say in passing that I am confident that our debtors can eventually carry the debt due to us with ease, provided they have the time necessary for the healing of their economic wounds, that they succeed in the reorganization of their fiscal policies so as to balance their government expenditure, and above all, that they secure disarmament and continued peace. Before the war the world carried a debt to a single European nation of twice the size of our foreign claims without knowing it, and with the renewed growth of the world's commerce and wealth our debt will be no burden. Our problem is the difficulties of our debtors during the few years until these blessings are attained.

"All of my rightful and optimistic view that we will maintain the flow of our goods is based upon the assumption that we can wisely manage these credit problems. There is a general agreement that we must extend credit if we would market our surplus and upbuild our customers during these next few years of readjustment, but as to the methods there are many minds; there are those who would directly try to stabilize exchange back to parity; those who would create securities jointly guaranteed by the principal nations, either through international banks of issue, bonds or currency; those who would extend credits directly or indirectly from the United States Treasury to buyers of goods, in order to stimulate exports; and also those who have confidence that the processes of business will find their own way out.

"Attempts to bring exchange to parity or to create international securities of any kind are open to the objection that they involve an element of inflation and that they practically open the gates of credit from the United States without regard to risk, how its purpose affects us or whether it really benefits the borrower. Loans from our Government direct to foreign governments or foreign merchants have a hundred objections and disagreeable entanglements which we learned well enough during the war. In all this maze of difficulty and the unsettlement over credits and debts, I would sum up that wisdom consists in knowing what to do next rather than debates upon perfection.

"As necessary as the continued establishment of foreign credits are, if we are to maintain our large volume of export trade, we should not overestimate the amount needed for legitimate trade for refinance and for reconstruction purposes. The amount is not so great as popularly supposed and will annually decline. I believe all trading states of consequence in the world can even now finance their imports of food supplies. The stronger of them can finance their imports of raw materials. We are, indeed, importing very much larger quantities of tropical produce than before the war and our own consumption of these commodities will continue to grow. The margin of credits needed beyond our imports in order to keep commerce alive for the present are, first, comparatively short term amounts to cover part of our exports of raw materials and the distribution period of our manufactured goods and, second, constant refinance of debts or interest already owed to us.

"In summary, on the production and marketing side of our commerce, we can say that our food exports should remain on a greatly enlarged scale; that the demand for our raw materials should slowly increase toward pre-war amounts; that in respect to our manufactures we should be able to hold special fields of repetitive production and ingenuity; that we will need to make a fight to hold the markets for manufactured goods where we come more directly into competition with the European manufacturer but that we can do it if we will work and apply our brains to it. On the financial side of our situation, I do not believe our world credit situation is at all so unsurmountable or that it requires extraordinary solutions.

"I may repeat that we need to realize above all things, that even if we lower our vision of civilization in this crisis solely to that of our own selfish economic interest, we are mightily concerned in the recuperation of the entire world. There is an economic interdependence in the world that recognizes no national boundaries. The greatest jeopardy to the standard of living of our people is the lowered standards of Europe. Now that we have become a great debtor nation, we must learn that this great debt must be wisely directed so that we do not stifle both our own growth and the growth of others.

"There are, indeed, many complexities arising out of our great expansion on productive power and our suddenly born creditor position. I do no need to say that we are confronted with a hundred difficulties, that we must be alert to steer our commercial policies against the winds of the world in an economic storm. We are suffering greatly in this immediate world-wide industrial depression. This depression is partly due to the war; it is partly due to our post-war boom, with its speculation, its extravagance, and its slackening of efficiency. The Government can help recovery by removing the obstructions to commerce and industry. But when all is done, the real cure for all depressions is courage and applied intelligence and the return to primary virtues of hard, conscientious toil and economy in living. On every side there is evidence that the vast majority of our whole nation is making again an effort in those directions equalled only by that of 1918, and the day some months ago when we entered this effort we fundamentally turned the corner of this depression. While our recovery may be slower than some may expect, nothing can prevent the prosperity of a country where the people have enlightenment, wish to work, wish to produce, and wish to do right by their neighbors.

"We are not a nation of machines and houses, factories, and railways. We are a nation of men, women, and children. Our industrial system and our commerce are simply implements for their comfort and happiness. When we deal with those great problems of business and economics we must be inspired by the knowledge that we are increasing and defending the standards of living of all our people. Upon this soil grow those moral and intellectual forces that make our nation great."

Ford Plant Breaks More Records for Production

A new high record for production in one month was reached at the Ford Motor plant at Detroit, Mich., in June, the total cars and trucks being 108,962, a statement by the company says.

During April, May, and June the production of Ford cars and trucks was 301,796, an increase of more than 80,000 over a year ago.

The July schedule calls for an output of 109,000 cars and trucks. A car or truck will leave the assembly line every 6½ seconds, if this schedule is maintained—a production of 4,360 cars a day.

Steel Prices and Wages Still Going Down

The United States Steel Corporation has announced another reduction in steel prices and also a cut in wages. With the new price schedule in effect, the whole steel industry of this country will again be practically on a uniform base. The last time that the industry was uniformly quoting the same schedule was April 15 last, since when there has been more or less cutting by various independents on all products and by the leading interest on several products. The Bethlehem Steel Corporation has published a new schedule of prices, or rather made official the prices current in the market, which is exactly similar to the recently one put out by the Steel Corporation. The Republic Iron and Steel Co., the Lackawanna Steel Co. and most of the independents that were not already quoting the new base or lower, followed suit. The new prices are not down to pre-war levels as yet as shown below. The new prices as compared with those recently current and some of those quoted in January, 1913 follow:

Finished steel products.	New price.	Old Jan. price.	'13 price.
Bars	$1.90	$2.10	$1.20
Structural shapes	2.00	2.20	1.75
Plates	2.00	2.20	1.75
Blue annealed sheets	2.65	2.85	....
Black sheets	3.50	3.75	2.31
Galvanized sheets	4.50	4.75	3.46
Tin plate	5.75	6.25	3.60
Semi-finished—			
Sheet bars	35.00	39.00	30.00
Billets, 4 x 4	33.00	37.00	28.30
Slabs	34.00	38.00	.....
Skelp	2.00	2.20	.....

Russia's Orders for Railroad Supplies

By V. Leitis
Riga, Latvia

(Formerly representative in the U. S. of the United Credit Union of Siberia.)

Soviet-Russia has ordered 1,000 locomotives in Germany and 700 in Sweden. All railroad orders are centralized in the hands of a special Russian railroad mission with headquarters at Stockholm and agencies in Berlin and London. The locomotives ordered are all of the old Russian type and are for freight only.

The Bolsheviki report that they will not order any passenger locomotives in the near future. The reason for this is that at present the condition of tracks and cars do not allow traveling at high speed. The average mileage for trains in Soviet-Russia is 230 miles in 24 hours. Trains are short and locomotives must be changed every 40 or 50 miles. The Russian climate has much to do with the condition of the track. Crossties are of pine, not treated with a preservative. From a total of 87,000,000 crossties 13,500,000 should be changed in 1921, but only about 5,500,000 will be changed. Compared with American standards the entire 87,000,000 should be changed.

From a total of 455,132 cars 95,000, according to the Bolshevist reports, are in bad order. The truth is that not less than 50 per cent are in bad condition. Soviet-Russia is sending to Latvian harbors so called newly repaired cars to receive goods for interior Russia, but many of these cars must be uncoupled after they have traveled some 50 miles with load. Passenger cars are in even worse condition.

The railroad control system is out of order. At the beginning of 1921, 32,000 from a total of 38,000 railroad telephones required repairing and 8,500 from a total of 10,250 telegraph instruments were in the same condition.

It seems that the Bolsheviki wish to replace only those locomotives which are over 45 years old. There were in Russia in 1914, 147 locomotives over 50 years, 1,537 from 40 to 50 years, 2,083 from 30 to 40 years, 1,247 from 20 to 30 years, 7,937 from 10 to 20 years and 7,108 under 10 years. Of course, the war with its heavy work and the attending improper repairing caused the majority of the locomotives to get in very poor condition. The Bolsheviki are endeavoring to make repairs and they boast that they now have in operation 19,157 locomotives against 9,400 in 1920. These figures are hard to believe as parts of the damaged locomotives are sent to Latvia and parts to Esthonia.

Soviet-Russia has ordered in Germany and in Sweden reserve parts and repairs for locomotives, cars and tracks valued at about 56,000,000 Swedish krones. Included among these parts are some 500,000 boiler flues at 200 gold roubles per ton; 124,000 poods of tin at 1,950 gold roubles per pood; 880,000 poods of lead at 183 gold roubles per pood; and rails at 91 gold roubles per ton. Some of these parts have been shipped across Latvia and Esthonia and the remainder of them will reach Russia by or during August. According to the Bolsheviki these supplies are estimated to cover their requirements for one year.

The locomotives that have been ordered will cost on an average of 130,000 gold roubles each. According to the reports of the railroad mission the German prices are 30 to 50 per cent lower than the Swedish and English prices because of cheaper German labor. The mission intends to order more parts in Germany and send them to Sweden to reduce the cost of production of locomotives ordered there.

The orders in Germany are distributed among nineteen factories and the total order of 1,000 locomotives is expected to be completed by March 1922. The 700 locomotives ordered in Sweden are to be built by the Nidkost & Holm Works as follows: 50 in 1921; 150 in 1922 and 250 each year in 1923 and 1924.

The 17,000 locomotives are not a large quantity for Russia but she has neither gold nor valuables to pay for more. The total cost of the present order will be about 250,000,000 gold roubles. In January 1921 Soviet-Russia had only about 350,000,000 roubles in gold. In addition to the necessity for repairs she has other needs and other expenses. Export business is slight and will remain that way so long as the Bolshevist-Communist regime remains in Russia. Recently there was some declaration that Russia will cease to pay for purchases with gold and will pay instead with goods. This is not because they have become thrifty but rather because they have no more gold.

Will Soviet-Russia order locomotives in the United States? This is a question hard to answer. The Bolsheviki are claiming that there were ordered in America, and paid for by Kerensky, 265 locomotives which were not delivered to Russia but were taken on lease by the Government of the United States and that at present the government refuses to deliver these locomotives to Soviet-Russia. It is said that at least sixty speculators offered them to the Bolsheviki officials at reasonable prices. The Bolsheviki believe that these locomotives were paid for by Russia, belong to Russia and should be delivered to her without additional payment. It seems pretty clear that the Bolsheviki receive better treatment in Germany, England and Sweden than in the United States and that their orders are influenced accordingly.

Washington Notes

By Paul Wooton
Washington Correspondent

One of the important considerations of present day military development, in the opinion of Brigadier General William S. Peirce, Assistant Chief of the Ordnance Department of the Army, is to avoid the assumption that the next war will be fought along the lines of the last struggle. Were the next war to come even ten years hence, it would be fought along lines vastly different from those followed during the struggle with Germany. He points to potent possibilities in mechanical devices. Officers of the Army and Navy recently have seen a battleship without a soul on board started, stopped, steered and intricately maneuvered by radio from a distant point. This, General Peirce says, in discussing the matter with the Washington correspondent of *American Machinist*, suggests that whole fleets of ships could be sent into combat without endangering the lives of their manipulators. That airplanes and even tanks can be adapted to similar control seems to be well within the range of possibility. While General Peirce cautioned against any jumping to conclusions before theories or experiments are fully developed, he cited this example of what may be developed in the next few years. Predictions can not be made as to just what the changes will be, but nevertheless it is entirely certain that the procedure in the next war will be as different from the practice during the last war as was the Civil War from the World War. The principal change, General Peirce forsees will be because of mechanical developments. The Ordnance Department, he says, is trying to keep its eyes open to the possibilities of developments of all kinds and while there is a tendency on the part of long established institutions, like the Army and the Navy, to be too conservative, every effort is being made to avoid any Bourbon-like policy.

Particular attention is being given to the developments in aviation. It is admitted that the increasing effectiveness of the airplane carries with it the possibility that all artillery may be immobilized. The point almost has been reached at which it is highly advisable to make important artillery movements in the darkness of the night.

Up-To-Date Equipment

General Peirce cautions against placing too much reliance on our accumulations of munitions. When the time comes to use much of this material it will be found to have become obsolete. In addition to munitions, there is also the matter of gages, dies, fixtures, tools and special purpose machines. These are valuable only, General Peirce declared, for the reproduction of the same kind of articles. It is the desire of the Ordnance Department to conduct its affairs in the same way an enterprising manufacturer would conduct his establishment. Development in the automobile industry, for instance, is such as to necessitate continual changes in equipment. There is a tendency on the part of the public to think that ordnance manufacture can stand still during the interims between wars. In the effort to be best prepared for any emergency, the Ordnance Department is co-operating very closely with private manufacturers. Every new design is submitted to these manufacturers. Careful consideration is given to any objection which the manufacturer may point out in the study of the design, from the standpoint of quantity production. In that way designs are in readiness at all times in case the country should be called upon to begin the production of the most improved war material.

The New Tariff on Metals and Machinery

In explaining the tariff schedule covering metals and manufactures thereof, Representative Tilson of Connecticut, chairman of the sub-committee which drafted the schedule, pointed out that the articles contained in that schedule had been divided into three classes.

The first class includes articles produced in large part by machinery where the element of labor is relatively small as compared with the quantity and value of the product. An example of articles falling in this class is iron and steel in the crude stages of manufacture. Mr. Tilson pointed out further that formerly many articles of a higher state of manufacture fell within this class because labor saving machines and appliances were used to a degree unknown in any other country. "With proper machinery," said the Connecticut representative, "and an adequate equipment of tools, jigs, dies, gages and fixtures, one American workman could turn out several times the output of his brother workman abroad." Under present conditions, Mr. Tilson said, much of this advantage has ceased to exist and in many of the older industries has ceased entirely to exist.

In the second class the Tilson sub-committee placed articles produced by industries which have been long established and thoroughly developed. In those industries advantages of labor saving devices have ceased to exist. The element of labor is relatively most important and the difference in labor cost is the controlling factor in competition. As typical of that class he cites clocks and cutlery.

The third class consists of those articles the production of which was begun or developed during the war period and which have not yet reached the point where they can compete with the older industries in foreign countries. As examples of articles falling in that class he cites surgical and scientific instruments.

Discussing clock manufacture, Mr. Tilson pointed out that so-called watches of the Waterbury and Ingersoll types are not watches at all, but clocks. They are made without jewels and built in the same way as are the cheaper clocks. "When it became possible for a comparatively few workmen," said Mr. Tilson, "with a number of power machines properly equipped to stamp out parts of these clocks by the cartload, then the making of the clock became a simple problem of assembling. The same work was done in foreign countries largely by hand. Hence however low the wage there, the cost was considerable. Now foreign manufacturers not only have as good machines but in many cases the very kind of machine made in this country."

In addition to machine tools and parts of machine tools, which call for a rate of 35 per cent ad valorem, the Fordney bill contains many other items of interest to the machinery industry. Steam engines and steam locomotives take a proposed rate of 15 per cent ad valorem. Automobiles and parts of automobiles, not including tires, carry a proposed rate of 25 per cent ad valorem. This item carries the proviso that if there be imported into the United States similar articles manufactured in or exported from any country which imposes a duty greater than 25 per cent ad valorem, "there shall be levied, paid and collected upon such articles a duty equal to the duty imposed by such country upon such articles imported from the United States, but not to exceed in any case 50 per cent ad valorem." The duty proposed for airplanes, hydroplanes, motor boats and their parts is 30 per cent ad valorem. Bicycles and motorcycles take the same rate.

Agricultural implements are on the free list. In this category is included machinery for use in the manufacture of sugar. Other items on the free list are cash registers, linotype and all typesetting machines, sewing machines, typewriters, shoe machinery, sand-blast machines, sludge machines and tar and oil spreading machines.

New Iron and Steel Works in South Africa

The Newcastle Iron and Steel Works in South Africa is expected to commence production about the middle of this year. It will be equipped with 4 Cowper stoves, 50 coke ovens, 5 boilers to be fired with pulverized fuel, and a blast furnace 70 ft. high and of 3,000 tons per month capacity. To begin with the furnace will be hand charged, but it has been erected with a view to mechanical charging at a later date. A site for another furnace of similar design has been selected, and it is proposed to proceed with its erection in the near future.

Business Items

The clubrooms and library of the Swedish Engineers' Society of Chicago have been removed from the City Hall Building to the new clubhouse at 503 Wrightwood Ave., Chicago, Ill.

The Raymond Rims and Wheel Co. Toledo, Ohio, has been incorporated with $50,000 capital stock, by A. A. Meggett, Benjamin T. Batsch, E. M. Sieloff, E. H. Young and Forrest Jeffries.

The B. M. Jones & Co., Inc., Cleveland branch, 115 St. Clair Ave., N. W., is now being managed by the Connelly & Kendal Co., which has moved into the above address.

The King Tool Co., Asbury Park, N. J., has been incorporated with $100,000 capital by A. C. Klopper, Joseph Pilling and Joseph C. Tynan, to manufacture tools and mechanical products.

The Johnstown Steel Car & Supply Co., Johnstown, Pa., has been incorporated with $600,000 capital stock, by H. H. Thompson, I. Schermin and H. Earl Sorber, to manufacture mine car wheels, etc.

The Hawkins Traction Flange Co., Pittsburgh, Pa., is being organized by Albert C. and Anthony J. Pauley and M. J. Koch, to manufacture flanges for traction wheels.

The Pitt Railways Equipments, Ltd., Montreal, Canada, has been incorporated with $1,000,000 capital to manufacture electrical railway equipment, machinery, tools, appliances, etc., by George L. Alexander, William A. Pitt, both of Montreal; John W. McLeod, New Glasgow, N. S., and others.

The Wonder Recharger Co. of Canada, Ltd., Montreal, has been incorporated with $150,000 capital stock to manufacture electrical machinery and equipment, by John W. P. Ritchie, Leslie G. Bell and others of Montreal.

The British Empire Steel Products Co., Ltd., Montreal, Canada, has been incorporated with $100,000 capital to manufacture iron, steel, metals, castings, forgings, machinery, tools, implements, etc., by Frederick H. Markey, Waldo W. Skinner, George G. Hyde and others, all of Montreal.

The Combined Grate and Radiator Heating Co., Knoxville, Tenn., has been incorporated with $30,000 capital stock, and will operate a plant at Fountain City, Tenn. Organizers of the company are H. E. Kelly, W. E. De Armond and others.

The Richard Punch and Die Corporation, Detroit, has been incorporated with $200,000 capital stock, by Otis K. Richard, Clement C. Richard and Clarence A. Richard.

George F. Snyder, Inc., Alpine, Mich., has been incorporated with $50,000 capital by George F. Snyder and Samuel Taig, to manufacture aluminum, brass, bronze and other metal castings.

The Detroit Alloy Steel Co., Detroit, has been incorporated with $50,000 capital by Frank L. Griffin, Robert H. Hall and John Grant, to manufacture alloy steel products.

The Associated Machinery Corporation, New York, recently was incorporated with $50,000 capital stock, by H. Harnischfeter, A. G. Hendricks, J. F. Dempsey and F. J. Knorr of Albany, N. Y.

The South Jersey Iron Foundry, Inc., Pleasantville, N. J., has been organized to make iron and steel castings, by W. C. Arnold, Commonwealth Building, Philadelphia, and others.

The Newark Die Co., Newark, N. J., has been incorporated with $50,000 capital stock, by L. G. Alerstok, John Hohl and H. H. Kunzelman, to manufacture dies, etc.

The Behrens Crane Co. Merchantville, N. J., has been incorporated with $125,000 capital stock, by Albert Burling, J. N. Wilkins and others, to build cranes, etc.

The Canuck Tool Mfg. Co., Ltd., Toronto, Ont., has been incorporated with $40,000 capital to manufacture tools, etc., by Arnold K. Graham, Percy I. Innes and Frederick E. Claxton.

The Continental Electric Co., Ltd., Toronto, Ont., has been incorporated with $40,000 capital to manufacture and deal in electrical appliances, etc., by M. L. Gordon, Bert H. L. Symmes and Craig A. C. McKay, all of this city.

The New England Smelting Works, Inc., Springfield, Mass., has been organized with $25,000 capital by A. J. Saffer, Morris Levin and P. M. Saffer.

The Stay New Filter Corp., Rochester, N. Y., has been incorporated with $100,000 capital by W. F. and L. L. Dellinger and J. J. McInerney, Insurance Building, to manufacture air filters for automobile service.

The Master Piston Ring Corporation, New York, has been incorporated with $50,000 capital stock, by B. Bursch, J. I. Polstein and S. S. Budlong, to manufacture piston rings, etc. The company is represented by Sanders, Zelenko and Polstein, 217 Broadway.

Coates Steamers Inc., Terre Haute, Ind., has been incorporated with $5,000,000 capital stock, by Earl R. Cox, W. S. McCloud, Terre Haute, and Louis Clements, Danville, Ill., to manufacture steam-driven automobiles.

The Victor Piston Ring Co., Baltimore, Md., has been incorporated with $500,000 capital by George D. F. Robinson, F. Pyrce and E. A. Leiby, to manufacture piston rings, automobile accessories, etc.

The Buffalo Shock Absorber Corporation, Buffalo, has been incorporated with $50,000 capital stock, by A. J. Argue, F. A. and J. P. Abbott.

Samuel E. Bernstein, Inc., New York, has been incorporated with $300,000 capital by P. J. M. and Samuel E. Bernstein, to manufacture cutlery, etc.

Warren Bros., East London, Ont., are making arrangements to erect a machine shop here at a cost of $25,000, and will shortly be in the market for machinery and general equipment.

The Bridesburg Foundry and Engineering Co., Philadelphia, has been incorporated with $125,000 capital to manufacture foundry and machine shop products, by Wary C. Arnold, Harold C. Lansinger and Frank A. Cabeen Jr.

The Hineline Engineering Co., Providence, R. I., has been incorporated with $300,000 to build machinery and make tools, by Theodore Beauregard, Leon S. Courcy and John B. Pinault.

The Barde Industrial Co., Seattle, has purchased a tract on which it plans a steel storage warehouse and machinery depot at an estimated cost of $250,000.

Personals

H. P. Simpkinson, has been transferred from the home office of the C. & G. Cooper Co., Mt. Vernon, Ohio, builders of engines and generators, to Dallas, Texas, where he has taken charge of the company's office.

Stanley Mazurek, Jr., of the sales force of the Federal Machine and Welding Co., Warren, Ohio, has been appointed manager of the Chicago office of that company. A. E. Hackett succeeds Arthur E. Meyer, who resigned as manager of the Detroit office.

J. E. Thorp, Jr., who has been superintendent of the blast furnace at the Columbus, O., plant of the American Rolling Mill Co., Middletown, O., has resigned.

William N. West, formerly superintendent of mills and roll shop of the Elyria Iron and Steel Co., Elyria, Ohio, has been appointed general superintendent to succeed Walter Ferrier, resigned.

Charles H. Collins, president of the Village of Colonie, and who for the past eight years has been associated with Stephen Sanford & Sons, Inc., Amsterdam, N. Y., as inventor and mechanical expert, has severed his connection with that firm and hereafter will devote his entire time to the manufacture and sale of carpet, silk and knitting machinery. The Perkins Machine and Foundry Company, Inc., of which he is the president and majority stockholder, is being reorganized and will be known in the future as the Collins Loom Works, Inc.

R. C. White, manager for the B. M. Jones & Co., Inc., Cleveland branch, has been appointed special western representative, of that company and will be located in Chicago. His headquarters will be with the western sales agents, Crerar Adams & Co., of 259 E. Erie St.

K. A. Juthe, for eighteen years with Wheelock, Lovejoy & Co., of New York, has joined the forces of the American Industrial Furnace Corporation and the American Metallurgical Corporation as chief engineer and treasurer.

H. M. Thomas of Oakland, Cal., has been appointed district representative on the Western coast for the Batterman-Truitt Co., of Chicago, Ill.

Harry F. Quinn, vice-president of the Fairbanks Company and manager of the New Orleans branch, has submitted his resignation, the same to take effect immediately upon the appointment of a successor.

I. D. Bielostozky has arrived in this country from Russia as representative of Morris & Bramer, of Petrograd. He is desirous of getting in touch with manufacturers of high-class machine tools with a view of securing their representation at Vladivostok. Mr. Bielostozky can be reached at 44 Whitehall St., New York, care of the W. P. Neth Co.

Col. C. L. H. Ruggles, who organized the technical division of the Ordnance Department and who has been in active charge of it since its foundation, January 1, 1919, has been instructed to take the next course at the Army War College. He will be succeeded as chief of the technical division by Col. John W. Joyes, who has been in charge of the Artillery Division of Ordnance. Col. Samuel Hof will succeed as head of the Artillery Division.

Nicholas A. Buotich has sold his interests in the business and equipment of the American Foundry at San Diego, Cal., to his partner, Bartholomew Skarpa, and the latter will continue the business, still using the name of American Foundry.

W. L. Conrad, who for many years was manager of the office of the late H. L. Gantt, assisting in the introduction of modern methods of management in industrial plants throughout this country, has opened an office in New York for consulting practice in management. He will follow along the lines advocated by Mr. Gantt and the work contemplated will include the introduction of modern methods of management, production and costs.

A. M. Morrell, formerly purchasing agent for Nordyke & Marmon Co. of Indianapolis, Ind., is now sales engineer of the Edward R. Ladew Co., Inc., and is located in San Francisco, Cal.

George Greenlee, formerly general superintendent and mechanical engineer for the National Wire Wheel Works, Geneva, N. Y., has become connected in the same capacity with the Morrison Machine Products, Inc., Rochester, N. Y., maker of collets for lathes and screw machines.

J. M. Meany is now president of the Ball Engineering Co., Portland, Ore. He was formerly western manager for the Clyde Iron Works, of Duluth, Minn.

Edgar MacNaughton has been made professor of mechanical engineering at Tufts College, Mass.

Philip W. Swain is now associate editor of *Power*. He was previously with the Franklin Manufacturing Co., Franklin, Pa.

L. W. Helmreich, formerly with the Arkansas Corporation Commission, Little Rock, Ark., is now chief mechanical and electrical engineer for the Missouri Public Service Commission, Jefferson City, Mo.

I. N. Zavarine, until recently metallographist for the Winchester Repeating Arms Co., New Haven, Conn., has been appointed assistant in mechanical engineering department of the Massachusetts Institute of Technology, Cambridge, Mass.

Paulsen Spence is no longer connected with Crane Company but has accepted the position of sales engineer for A. W. Cash Co., valve specialists of Decatur, Ill. His headquarters are in Detroit, Mich.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

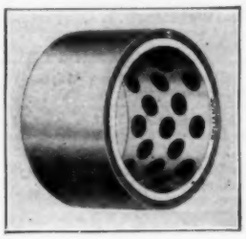
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Bearing, Self-Lubricating

Reliance Machine and Specialty Co., 101 Green St., Jamaica Plain, Boston, Mass.

"American Machinist, April 14, 1921

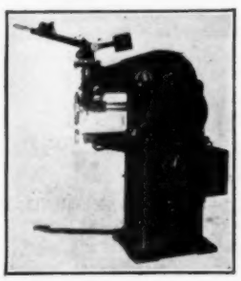


The bearing is made both in a wide range of sizes, and in many different types, both radial and thrust. The illustration shows one of the standard types of radial bearing or bushing. The bearing consists of two parts, the outside bushing usually being made of steel tubing. The inner bushing is made of bronze, and is drilled with a number of ¼-in. holes, the holes being slightly larger on the outside than on the inside of the bushing, so that the lubricating mixture with which the holes are filled will be retained in them. In assembling the bearing, the outer casing is expanded by heating and then shrunk on the inner casing, after which the two are pinned together. Neither of the bushings is split.

Welding Machine, Spot, Series-4.

Taylor Welding Co., Warren, Ohio.

"American Machinist," April 21, 1921

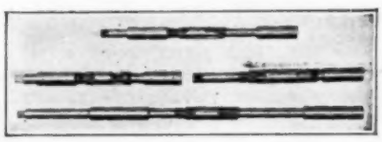


The machine is intended for welding together pieces of sheet steel from 1/64 to ¼ in. thick. The operation is by hand lever and treadle, used either together or independently of each other. When using the automatic switch the elecrodes are brought in contact with the work under spring pressure, further movement of the hand lever or treadle turns on the current, the work heats immediately to a welding temperature, and continued movement of the lever or treadle turns off the current and applies pressure to the molten metal to complete the weld. The machine can be adapted to 220 or 440-volt, 25 to 60-cycle single phase alternating current. A 10-step self-contained regulator is provided for adjusting the current. One set of 1¼-in. water cooled electrodes, 2 straight, 2 offset and 1 flat, are standard equipment.

Reamer, Line, Expansion

New Britain Tool and Manufacturing Co., New Britain, Conn.

"American Machinist," April 21, 1921



The reamer is intended primarily for use in the garage and automobile repair shop, for the purpose of reaming to a standard oversize the worn holes in pistons and connecting parts of automobile engines. All parts are of tool steel, hardened and ground to size. The cutting part of the tool is not different from the regular expansion reamer made by the same concern, except that it is placed in the middle of a long shank to which adustable bushings are added, so as to guide the cutting portion when reaming holes that are worn out of size or shape.

Press, Screw, Double

Toledo Machine and Tool Co., Toledo, O.

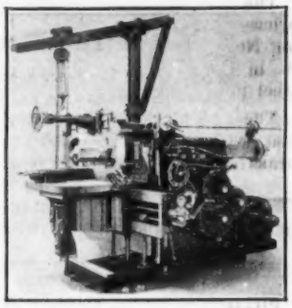
"American Machinist," April 28, 1921

The press is made with sufficient capacity and area of bed to try out dies such as used for blanking, forming, drawing and stamping sheet metal and which are too large for the ordinary single-screw press. The frame is of the four-piece, tie-rod construction. It is fitted with two screws 4 in. in diameter. The bed is arranged with a powerful spring-pressure drawing attachment, which can be used when trying out combination and deep-forming dies. Weight, about 14,000 lb. Area of bed, 30 x 54 in. Area of slide, 24 x 49 in. Height of slide above bed: slide down, 14½ in.; slide up, 32½ in.

Shaper, Railroad, Draw-Cut, Heavy-Duty

Morton Manufacturing Co., Muskegon Heights, Mich.

"American Machinist," April 21, 1921



The machine is intended for rapid production work in railroad shops on driving boxes, crown brasses, shoes and wedges, and connecting-rod brasses. On work within the range of the tool, it is said to remove metal as fast and as accurately as a planer, although it consumes one-third less power than a planer and takes half as much floor space. The taking of the cut on the back stroke increases the capacity of the machine. The column is of heavy box section and provided with square rail bearings. The ram is made of steel, is square in section and cast hollow. The length of stroke is adjusted by tappets on a circular disk, and can be changed while the machine is in operation. Either belt or motor drive and all necessary fixtures can be furnished.

Tractor, Twin Steering Wheel

Mercury Manufacturing Co., 4118 S. Halsted St., Chicago, Ill.

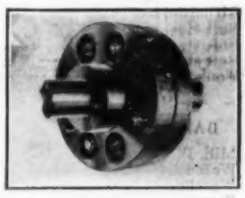
"American Machinist," April 21, 1921

The steering arrangement now put on the company's line of industrial tractors is designated as the "Twin-Three" and is shown applied to a type "L" tractor. It consists of two wheels mounted on a very short axle, which is attached to a bracket by a semi-elliptic spring. The bracket supports the front of the chassis and its trunnion is directly attached to the steering lever. The steering is accomplished in the same manner as though there were a single wheel carried in a fork.

Coupling, Shaft, Flexible

Ajax Flexible Coupling Co., Westfield, N. Y.

"American Machinist," April 21, 1921

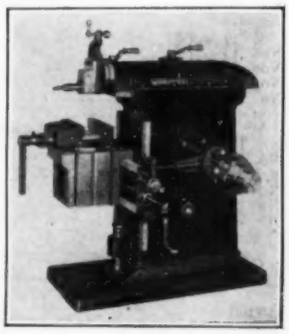


The coupling is simple in construction, being made of two flanges into which are fitted hardened steel bolts projecting from one flange to the other and entering oilless bronze bearings, the heads of the bolts being on alternate sides. The bolts pass through flexible members, each consisting of a brass sleeve into which is compressed Para rubber surrounding the bronze bearing. The bolts have free endwise movement through the bearings. The coupling can be put on the shaft either assembled or disassembled. There are no projections from the body of the coupling. The coupling permits the connected shafts to float freely in their own bearings, compensating for both endwise movement and angularity between the shafts.

Shaper, Crank, 12-in.

Whipp Machine Tool Co., Sidney, O.

"American Machinist," April 28, 1921



This 12-in., single-geared, crank shaper has a maximum stroke of 14 in. It is belt-driven and the cone-pulley is provided with three bronze bearings, one being located on each side of the bull-gear pinion to prevent the pinion from springing away from the bull-gear during a heavy cut. The third bearing is placed to insure the shaft alignment under a heavy belt pull and to avoid the necessity of an out-board support. The ram is of box-type construction and is fitted in square ways. It is driven by a long rocker arm. The swivel-head is graduated and is held in place by an eccentric lock. The vise has a graduated base, is fitted with tool-steel jaws and its screw acts tension. Shipping weight: domestic, 1,350 lb.; boxed 1,450 lb.

Clip, paste on 3 x 5-in. cards and file as desired

THE WEEKLY PRICE GUIDE

This Week's Market

The recent steel decreases are being reflected in the warehouse prices. Steel sheets are down 25c. per 100 lb. in Cleveland, making No. 28 black $4.25. Spring steel, both weights, down 1½c. per lb. in Cleveland. We show the new Pittsburgh basing card for steel pipe; discounts increased 2 per cent.

The metal market remains dull, with zinc a trifle stronger than last week. Metal products are sold at last week's prices, except brass sheets in Cleveland, which are down 2c.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.03	$2.89	$3.23
Soft steel bars	2.93	2.79	3.13
Soft steel bar shapes	2.93	3.48	3.13
Soft steel bands	3.63	6.25	
Tank plates	3.03	2.89	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	2.93
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.68	3.40	4.13
No. 12	3.15	3.73	3.45	4.18
No. 14	3.20	3.78	3.50	4.23
No. 16	3.30	3.88	3.60	4.33
Black				
Nos. 17 and 21	3.75	4.30	4.05	5.20
Nos. 22 and 24	3.85	4.35	4.10	5.25
No. 25 and 26	3.90	4.40	4.15	5.30
No. 28	4.00	4.50	4.25	5.40
Galvanized				
No. 10 and 11	4.00	4.50	4.25	5.70
No. 12 to 14	4.10	4.60	4.35	5.80
Nos. 17 and 21	4.40	4.90	4.65	6.10
Nos. 22 and 24	4.55	5.05	4.80	6.25
No. 26	4.70	5.26	4.95	6.30
No. 28	5.00	5.50	5.25	6.-0

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.43	$4.63	$4.00
Flats, squares and hexagons, per 100 lb	4.93	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 1/16, 8½c. per lb.; ⅛, 7.15; 5/32 to ¼, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	4.03	3.49	3.83
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	5.00	3.09	5.78
Special best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	64½	52	⅜	33½	18½
			½ to 1¼	35½	20½

LAP WELD

2	56½	44	2	30½	16½
2½ to 6	60½	48	2½ to 4	34½	22½
7 to 12	57½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	62½	51½	1 to 1½	35½	21½
2 to 3	63½	52			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	54	43	2	31½	18½
2½ to 4	58½	47	2½ to 4	34½	22½
4½ to 6	57½	46	4½ to 6	33½	21½
7 to 8	53½	40	7 to 8	24½	12½
9 to 12	48½	35	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	28.50
Lead	4.75
Zinc	6.00
ST. LOUIS	
Lead	4.35
Zinc	5.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.75	22.00	23.50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	18.00	10.75
Brass pipe	18.50	22.00	23.50
Solder (half and half) (case lots)	20.00	23.50	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and shot	41
Electrolytic	44

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.50	7.00	8.00
Lead, heavy	3.25	3.50	3.75
Lead, tea	2.00	2.50	2.75
Brass, heavy	5.00	5.00	9.00
Brass, light	4.50	4.00	5.00
No. 1 yellow brass turnings	5.00	4.00	5.00
Zinc	3.00	2.50	3.50

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	41.00	35.00
Commercial	30.00	14.75	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	1.60
Hot pressed hexagon	2.00	2.25	1.60
Cold punched hexagon	1.50	2.25	1.60
Cold punched square	1.50	2.25	1.60

Semi-finished nuts, ⅜ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	40%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $3.00 Cleveland..... $4.50 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.25 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	50%	60%	40%
Larger and longer up to 1 in. by 30 in.	45%	50-10%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50-10%	60-10%	45%
Tinned	50-10%	60-10%	30%

Structural, ½, ¾, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$4.25 Chicago....$4.88 Pittsburgh..$2.90

Boiler, same sizes:
New York...$4.50 Cleveland...$4.35 Chicago....$4.98 Pittsburgh..$3.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	18.00	24.00	25.50
Brass	16.00	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$6.85 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.75@$3.00
Prompt foundry	4.00@

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.76	$0.83	$0.84
5-gal. cans	.83*	.98	1.09

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White Dry and In Oil
	Dry	In Oil	
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.25
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg., manufacturer of machinery—one late model Ryers auto crane, caterpillar tread. Six jackhammer drills. One 10 ton, 3 wheel, double cylinder steam roller.

N. Y., Buffalo — The Artistic Leather Shop, 139 Sycamore St., G. Eberl, Prop.—one 40 in. bookbinder shear.

N. Y., Buffalo—Automatic Transportation Co., 2933 Main St., E. D. Miller, Purch. Agt.—woodworking machinery including sanders, shapers and mortisers, motor or belt driven.

N. Y., New York—V. Bach, 204 East 85th St.—one "Seneca Falls" lathe.

N. Y., New York—Kotz & Ogust, 26 West 47th St.—one power hammer.

N. Y., New York—The Noble Mchy. Co., 130 Bleecker St.—lathe, 48 in. swing, 8 or 10 ft. centers, must be double spindle, second hand.

N. Y., New York — Tiphany Phonetic Corp., 50 East 42nd St., manufacturer of talking dolls—

One No. 1 universal Ohio milling machine, complete. Two 14 in. high speed sensitive drill presses. One 20 in. back geared drill press. One No. 2 grinder complete with steel guards, etc. One No. 2 Reid surface grinder. One magnetic chuck. Two 9 in. x 4 ft. bench lathes. One No. 3 26 in. Brown & Sharpe automatic cutting machine. One No. 2 7 in. Rhodes horizontal crank shaper, complete. One 9 in. x 4 ft. screw cutting engine lathe. One No. 2 universal cutter and tool grinder. One No. 1 universal grinder.

N. Y., North Tonawanda—T. K. Banks, 60 Chipman Pl.—one 12 in. engine lathe, small drilling machine and small emery wheel.

N. Y., Rochester—Michel Machine Co., 71 North Water St., T. Michel, Purch. Agt.—all kinds of woodworking machinery.

N. Y., Rochester—Poze & Natapon, 17 South Water St. (general contractors)—medium size 2 spindle shaper.

N. Y., Silver Springs—Lucus Tuttle Mfg. Co.—automatic woodworking lathe.

Pa., Harmony—The Robinson Ventilating Co.—two electric cranes for machine shop.

Pa., Newport — Susquehanna River & Western R.R. Co.—

One No. 14 Berlin 4 side planer to work 20 in. wide x 14 in. thick with countershaft attached.

One 42 in. car wheel boring mill.

One center drawn axel lathe for turning axels.

One power driven hydraulic car wheel press, 250 ton capacity.

Pa., Philadelphia — A. Box & Co., Inc., 813 North Front St., G. A. Mitchell, Sales Mgr.—one Amer. four foot radial drill, motor driven by 220 volts, direct current (used).

Ala., Mobile—Reliance Equipment Co., 7 North Water St., manufacturer of paints, oils, wire rope, etc.—rubbing bed with disc, about 8 ft. diameter, under geared preferred.

La. New Orleans—The W. L. Baker Machine Wks., 819 Burgundy St., W. L. Baker, Prop.—36 in. radial drill, 12 in. dividing indexing center and 3 Universal jawed chucks.

La., New Orleans — The International Auto Repair and Serv. Co., 1133-34 North Rampart St., R. M. Lerch, business mgr.—medium sized lathe and equipment for automobile repair and machine shop.

La., New Orleans — Loubat & Cabirac, 1308 North Rampart St., J. Loubat, Prop.—one medium sized jack, reamers, die nuts, etc., for garage.

Ill., Chicago — The Acme Stamping & Machine Co., 637 Marshfield St.—4½ to 5 ton, 7 in. stroke, combination drawing press, die space of 12 to 15 in.

Ill., Chicago—The Birthman Electric Co., 640 West Lake St.—20 to 30 ton toggle press.

Mich., Detroit—W. J. Baird Mchy. Co., Jefferson and Bush Sts.—one 6 x 30 in. lathe.

Mich., Detroit—Dept. of Purchases & Supplies, Marquette Bldg., G. J. Finn, Comr.—one 6 ton electric traveling crane with 2 yd. clamshell bucket, for asphalt plant.

Mich., Detroit—Hinkley Motor Corp., 3420 West Fort St.—traveling crane and equipment for assembling plant at Ecorse.

Mich., Ironwood — Universal Auto Co. — repair shop machinery for garage.

O., Cincinnati—Randle Mchy. Co., Cincinnati, Hamilton & Dayton R.R. and Powers St.—one 48 x 48 x 12 planer, 14 or 16 ft. table, single head on cross rail.

O., Cleveland—The Bd. Educ., Rockwell Ave. and East 6th St.—portable grinder for use on blackboards.

O., Conneaut—W. E. Lewis—28, 30 or 32 in. lever or power paper cutter, also punching machine.

Wis., Hartford — O. Wollner & Co. — cheese making machinery, power driven.

Wis., Madison—The 3-F Laundry Co., 731 East Dayton St.—laundry machinery.

Wis., Milwaukee—Badger Concrete Mixer Co., 221 Grand Ave., E. McVicker, Mgr.—lathes, drill presses and other machine shop equipment; also sheet metal working machinery for factory at Winthrop Harbor, Ill.

Wis., Milwaukee—G. Getzlaf, 1016 19th St.—tool maker, slip roll forming machine.

Wis., Milwaukee—Mid Western Soap Co., 330 Caswell Blk.—special soap making and filling machinery.

Wis., Milwaukee—The Rogers Corp., c/o C. J. Hendricks, 487 Belleview Pl.—machinery and equipment to manufacture carburetors.

Wis., Milwaukee — Supreme Candy Co., 1222 8th Ave.—candy making machinery, including caramel cutters, sizers, rollers, beaters, etc.

Wis., Milwaukee — Thesco Mfg. Co., 425 East Water St., manufacturer of wooden novelties, H. E. Cogesall, Purch. Agt.—planers and rip saws.

Wis., Waukesha — Held & Kendall, 312 Harrison St.—repair machinery for garage, including lathe and drill press.

Mo., St. Louis—J. Greenspons Sons Iron & Steel Co., 3130 Hull St.—one pipe cutting and threading machine of lathe type to handle pipe from 6 in. to 12 in.

Neb., Omaha — Bd. Educ., c/o W. E. Burke, secy., City Hall Bldg. — manual training equipment for proposed high school on Burt, Cummings, 30th and 33rd Sts.

Ont., Belmont — J. Dawes — auto repair shop equipment.

Ont., Guelph—The Stewart Lumber Co., Wyndham St. — lumber and planing mill machinery and equipment.

Que., Montreal — Parissienne Shoe Co., 614 Lasalle Ave., I. Leclerc, Purch. Agt.—complete shoe making equipment.

Que., Montreal—Farand & Dalorme Co. Ltd., 228 Richmond St., I. Delorme, Purch. Agt.—equipment to fabricate acetylene gas.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—The Amer. Tube and Stamping Co., 471 Hancock Ave., plans to build a large 1 story plant on Wordin Ave. for the manufacture of hot and cold rolled steel. Private plans.

Mass., Brookline—Gorfinkle & Barkin have awarded the contract for the construction of a 1 story, 150 x 175 ft. garage on Harvard St. Estimated cost, $100,000. Noted July 7.

Mass., Pittsfield—The Berkshire Auto Co., South St., is building a 1 story, 60 x 232 ft. and 20 x 40 ft. garage. Estimated cost, $60,000.

Mass., Springfield—O. P. Thompson, et. al., 145 State St., are having plans prepared for the construction of an 8 story, 100 x 190 ft. garage and repair shop on Dwight St. Estimated cost, $700,000. R. B. Warner, 168 Bridge St., Archt.

R. I., Woonsocket—Lockwood, Greene & Co., Archts. and Engrs., 60 Federal St., Boston, Mass., receiving bids for the construction of a 3 story, 85 x 160 ft. plant on North Main St., here, for Shambow Shuttle Co., 583 Main St. Estimated cost, $125,000.

MIDDLE ATLANTIC STATES

N. Y., Jamaica—The Multiple Storage Battery Co., Van Wyck Ave., has awarded the contract for the construction of a 1 story, 60 x 125 ft. factory. Estimated cost, $60,000.

Pa., Harmony—The Robinson Ventilating Co. has awarded the contract for the construction of a 1 story, 60 x 120 ft. machine shop. Estimated cost, $25,000.

Pa., Pittsburgh—W. W. Martin Co., 5847 Center Ave., has awarded the contract for the construction of a 3 story, 100 x 140 ft. auto sales and service station on Ravenna St. and North Highland Ave. Estimated cost, $150,000. Noted June 23.

MIDDLE WEST STATES

Ill., Herrin—The Illinois Central R.R., c/o C. H. Markham, Pres., 135 East 11th St., Chicago, plans to build a 1 story repair shop, here. Estimated cost, $60,000. D. T. McLaughlin, 109 12th St., Chicago, Archt.